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THE
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CAROTID PAIN.*

JEROME A. HILGER, M.D.,
St. Paul, Minn.

Irregularity in autonomic balance produces many clinical pictures ranging from Raynaud's disease to neurovascular arthropathies in the extremities and from peptic ulcer to ulcerative colitis in the gastrointestinal system; however, clinical manifestation of autonomic imbalance is perhaps most common in the cranial segments of the sympathetic and parasympathetic systems. It is exhibited principally in alterations in the vasomotor control of the carotid arterial tree.

The carotid arterial tree is a dynamic set of muscular and elastic tubes which vary in their calibre according to the immediate environmental need. The variations in lumen are regulated through autonomic nervous system control. Autonomic innervation is distributed to the peripheral arteries through the many terminal nerve trunks of the head region as well as by way of the plexi on the major vessels. It is probable that the arteriolar level is more richly innervated than the arterial level.[13-15] From the functional and clinical standpoint the behavior of major arterial branches is of minor importance in comparison with the arteriolar perpihery.

*Presented as Candidate's Thesis to American Laryngological, Rhinological and Otological Society, Inc., 1949.

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Angiospasm at the arterial level can be effected through sympathetic impulse and may be of moderate clinical importance. The existence of primary vasodilatation at arterial level, on the other hand, has been a controversial subject. Both parasympathetic and sympathetic vasodilator innervation exists, but vasodilator influence in vessels larger than arteriole size is of doubtful clinical importance.

Angiospasm in vessels of arteriolar calibre is mediated through sympathetic innervation and is of major clinical moment. The influence of abrupt reduction in arteriolar blood flow upon a single capillary has been the subject of extensive study.[1-5] The ischemic capillary undergoes dilatation, and transudation results. There is considerable evidence to support the thesis that this simple functional vascular change is the basis of the wheal formation and edema of the allergic reaction.[6] The allergic state is inherent in an individual with an unstable and unbalanced autonomic nervous system.[7] Arteriolar spasm precipitated through the disordered control of this system may result in whealing anywhere in the organism.

Arteriolar spasm effected through sympathetic overbalance is frequently confined to one segmental arterial bed. The change in the major segmental artery supplying an arteriolar periphery which has undergone angiospasm as a unit must be one of vasodilatation. This passive dilatation resulting from peripheral obstruction results in pain in the affected arterial segment.

The walls of the carotid artery and its many branches are supplied generously with sensory nerve endings which ramify from adjoining sensory nerve trunks. Most of the fibres involved in the conduction of afferent impulses from the peripheral arteries reach the spinal cord and brain stem without traversing the sympathetic trunks.[8-10] Stimulation of these nerve endings is effected by stretch of the arterial wall and is appreciated as pain. The pain will vary with the degree of dilatation and can be extraordinarily severe. It is characteristically a deep-seated pain in contradistinction with the more superficial searing pain of primary nerve trunk or gan-

glion origin. It commonly is accentuated with the pulse and hence is described as throbbing. If the arterial segment is superficial, steady supportive pressure over the area frequently gives comfort in spite of the fact that indiscreet, jabbing palpation shows extreme tenderness along the arterial course. Deeper arterial segments, particularly those housed in bony canals, give throbbing, bursting pain identical with that arising from an empyema of a paranasal sinus.

The ramifications of one or many carotid branches may undergo the functional change producing angiodilating pain in the stem artery. It may occur on one or both sides or may alternate. There is a characteristically habitual pattern of dilatation in the individual case which gives a usual localization of pain. This may vary with time and circumstance, however. The typically hemicranic migraine frequently changes the character and location of his vascular pain in the course of years. The unilateral histaminic cephalgic alters in severity and place. Always, however, there is a basic segmental character to the abnormal neurovascular habit, though changes in location and degree may develop slowly through the years to produce a varied clinical picture.

The mild usual degrees of angiodilatation show no objective change at the site of pain. Palpable dilatation in superficial vessels may be noted in severer degrees of change, and areas of tenderness may persist long after the acute and painful phase subsides. Pain may originate from the dilatation of any arterial segment, superficial or deep, however, when the arteriolar periphery beyond is dammed by vasospasm.

A common site of dilatation is at the carotid bifurcation. The patient usually complains of the recurrent and abrupt onset of unilateral sore throat with the appearance of a "gland" in the neck. There is no evidence of inflammation. The bifurcation is palpable as a firm, extremely tender mass at the hyoid level. It pulsates—an important diagnostic point. Usually the tonsils have been removed in previous efforts to alleviate the recurrences of sore throat.

Atypical facial neuralgic pain, which is atypical because it does not correspond to sensory nerve distribution, in reality usually is angiodilating pain and is in no sense a neuralgia. The internal maxillary, superficial temporal and postauricular pain of sphenopalatine neuralgia usually arises from the pain endings in the arterial walls of those branches of the external carotid as they dilate. Cocainization of the sphenopalatine ganglion produces relief only if the spastic arteriolar bed is under control of the sympathetic fibres under blockage or if sufficient intranasal vasoconstrictor is administered to give systemic absorption and direct constrictive influence on the dilated arterial trunk. Removal or destruction of the sphenopalatine ganglion is an incomplete sympathectomy at best and has little to recommend it in the relief of cranial vascular pain because the sympathetic innervation of the carotid branches does not centralize well at the sphenopalatine.

The surgical trauma of intranasal septal surgery for removal of spurs, irregularities and impingements gives temporary relief to angiodilating pain because trauma admittedly alters autonomic balance for a time. The same may be said for removal of the edematous and hyperplastic mucosa of the paranasal sinuses at the periphery of the spastic arteriolar bed. This temporary pain relief is unfortunate. It is the foundation of the promiscuous intranasal surgery of the past many decades. Since it does not alter the basic unstable nature of the autonomic mechanism producing the pain, the surgical relief is transient and intranasal surgery has fallen into lay and medical disrepute.

Edema beyond the arteriole follows severe arteriolar angiospasm and presents objective evidence of swelling without inflammatory cause. This in the internal maxillary arterial distribution results in nasal and paranasal sinus mucosa edema and hypersecretion; in the periorbital vessels it results in conjunctival injection; in the superior thyroid artery it can produce severe intracapsular swelling; in the external maxillary, edema of the lip develops; in the infraorbital, tenderness and edema at the foramen is pronounced; in the

transverse facial, edema of the lower lid may be recurrent; in the ascending pharyngeal, pharyngeal edema and severe sore throat simulate pharyngitis; in inferior dental and alveolar branches the dull, pulsating throb of apical abscess is mimicked by edema of the pulp, etc.

The character of one's autonomic nervous system is a matter of inheritance. Unbalanced function, therefore, tends to familial distribution. The basic function of the autonomic system is that of adjusting the organism to its environment. Any individual may encounter environmental factors which place undue stress upon this mechanism. For some, this occurs more readily than for others. Even exposure to certain food or inhalant substances may, through autonomic mediation, create an antigen — antibody response in them which on subsequent exposure results in allergic neurovascular phenomena. The same may occur as a disordered response to physical factors of temperature and humidity and light in the environment. This reaction of physical sensitivity is elicited particularly upon abrupt alterations in the surrounding temperature and humidity. The most common precipitor of disordered autonomic response, however, lies not in these tangible environmental factors but, rather, in the individual's own emotional response to his environment. In the same individual, all of these factors may bear causatively on his neurovascular distresses. An exhaustive family and personal medical history is the principal means of airing these relationships.

CASE HISTORIES.

A 59-year-old woman had experienced recurrent severe pain in the right side of the neck and head for the past year. It had been unrelieved by migraine medications or treatments for sinus disease. She had had numerous thorough medical examinations without findings of organic disease. For a week the pain had intensified and become persistent. This change followed a crisis in a domestic situation which had been troubled for several years. This fact was not given due attention at the time of first history and examination because there were several salient objective findings which drew the red herring of inflammatory disease across the trail. The thyroid gland was noted to be intensely swollen and tender in a manner suggestive of acute thyroiditis; there was bilateral doughy swelling in the supraclavicular spaces; and there was a 2 cm. mass beneath the angle of the mandible, suggestive of an enlarged cervical lymph gland. Pain was intense and throbbing, and unrelieved with mor-

phine. There was no fever and hemogram was normal. Four days' intense therapy with penicillin and sulfadiazine brought no improvement. It was then felt that, in the absence of evidence of true infection, one must believe this remarkable clinical picture to result from neurovascular change alone. This belief was strengthened when it was noted that the cervical "gland" pulsated strongly and appeared in reality to be the bifurcation region of the carotid artery and that the right-sided head pain originated in the course of palpably tender and dilated superficial temporal, external maxillary and transverse facial arteries. Eight hundred milligrams of tetraethylammonium chloride given intramuscularly within two hours gave remarkable relief from a pain which had previously been unresponsive to repeated injections of 16 mg. of morphine. When the autonomic block at ganglion level was maintained by repeated injections of the tetraethylammonium salt, pain relief was maintained and the edema of the thyroid gland and the supraclavicular spaces disappeared within 24 hours. It was noteworthy that edema confined within the capsule of the gland evoked extreme pain and tenderness, while that in the loose and unlimited areolar tissues of the supraclavicular depressions caused little discomfort. When the tetraethylammonium chloride was withheld in a trial maneuver two days after the original injection, pain reappeared in six hours and edema became objectively apparent in nine hours. When the pain was again controlled, the patient was allowed to regulate the frequency of injection according to the reappearance of discomfort. The period of comfort increased, and in a week further autonomic block was unnecessary. It was feared that return to her previous domestic situation would precipitate recurrence. In spite of psychiatric help, this did occur and she was readmitted to the hospital in one month and again six weeks thereafter with identical symptoms and findings, and in both instances prompt relief was obtained from autonomic blockade.

A 52-year-old male had been continuously disabled for five years with recurrent episodes of severe left cervical and postauricular pain which usually initiated within a period of minutes a violent attack of left vasomotor labyrinthitis with roaring tinnitus, sharp decrease in hearing acuity, vertigo, nausea and vomiting. During the same period chronic vasomotor cochleariti had resulted in severe impairment of hearing acuity in the right ear and a constant buzzing tinnitus. He had consulted 28 doctors in the five years. The patient had had chronic vasomotor rhinitis and vasodilating pains in varying parts of the head for much of his adult lifetime. He had a parental and sibling background of vasomotor instability. He was acutely physically sensitive, and active rhinitis and vascular pain was frequently precipitated by physical exposure. The usual aggravant for his pain and inner ear episodes, however, was an emotional upset or period of nervous tension. When the pain appeared, the carotid artery was seen to dilate along its length to amazing size. On admission to hospital for study, one such episode occurred and the admitting physician noted the sausage-like cervical swelling as a probable "lymphangiomatous mass but of surprising tenderness." To his amazement it disappeared in an hour, leaving only a somewhat prominent carotid artery moderately sensitive to pressure.

On this and one other admission to hospital it was necessary to control severe vasomotor labyrinthine attacks and persistent angiodilating pain with tetraethylammonium chloride.

It is extremely difficult to root out neurovascular habits of this duration and severity. Medicines have a limited useful-

ness. With psychiatric care, regular use of the arteriolar dilating properties of nicotinic acid, occasional barbiturate sedation and peripheral neural block with pyribenzamine, the frequency of angiodilating pain and vasomotor labyrinthine attacks has diminished to a point at which the patient has resumed work and is in good part rehabilitated.

A 58-year-old woman had had recurrent attacks of "maxillary sinusitis" on the left side for one year. She had had a great deal of local sinus treatment and repeated courses of penicillin therapy by both injection and inhalation. Her acute attacks characteristically developed abruptly with pain in the left maxillary sinus area and the left upper teeth and a moderate rhinorrhea and nasal congestion on the left side. She at no time had evidences of suppuration in the way of purulent discharge, or fever. She frequently, with the more severe attacks developed swelling which was objectively evident in the soft tissues of the canine fossa region. On her first examination she was in the throes of such an attack and there was objective evidence of edema in the canine fossa which extended modestly upward into the left nasomaxillary groove. There was marked tenderness to pressure over the infraorbital foramen. There was a mild turbinal edema and a modest excess mucous discharge in the left nasal space. The sinuses transluminated clearly, and there was no evidence of mucopus in the nose or in the nasopharynx. She was afebrile.

It was suspected that the patient's recurrent difficulty was not inflammatory in nature and careful history elicited the fact that her "sinus attacks" were precipitated almost invariably by a period of difficulty with her husband. An injection of 1cc. of ergotamine tartrate intramuscularly gave her rather prompt relief of the pain, though the tenderness in the edematous area and over the infraorbital foramen remained pronounced for some period of time. Subsequent comfort was provided by the daily use of nicotinic acid and the early use of 50 mg. doses of pyribenzamine at the slightest sign of angiodilatation. On two occasions, however, the patient awakened with the pain well established and the edema already forming, and pyribenzamine was found to be ineffective as a means of relief. In the last six months, after establishing a satisfactory adjustment in her domestic affairs, she has had no recurrences of the attacks which previously had averaged one to two severe episodes per month.

A 35-year-old woman was first seen for a chronic vasomotor rhinitis and right chronic vasomotor cochlearitis. She had had a marked physical sensitivity and dust sensitivity since she was 17 years of age, which expressed itself in the form of active rhinitis, particularly during the inclement seasons of the year and during the winter heating season. A year before examination she had developed tinnitus and progressive hearing impairment in the right ear. She had had no vertigo. Her audiogram showed an average 30 db. loss of an inner ear type with a marked involvement in the high tones. Her general examination showed nothing of moment.

House dust desensitization and daily use of nicotinic acid during the inclement periods of the year gave her satisfactory relief from her rhinitis and reduced the frequency of tinnitus from that of constant annoyance to occasional periods of tinnitus, usually precipitated by physical exposure or fatigue, particularly at the time of her menstrual period.

She was subsequently seen following death of a member of her family. The complaint at this time was severe sore throat, of four days' duration, on the right side and pain and swelling localized over the mandible on the right side, and involving the right upper lip. What the patient had taken for a spreading infection in reality showed no inflammatory signs whatsoever. The bifurcation of the carotid artery on the right side was found to be markedly prominent and pulsating and had given the patient the impression that she had a glandular swelling in her neck. The external maxillary artery in its course over the ramus of the mandible was very prominent and showed marked pulsation and tenderness in its course. The region of the artery in the soft tissues of the right cheek and to its terminals in the upper lip was palpable between finger and thumb as a cord-like swelling with quite pronounced edema surrounding. The patient obtained relief from ergotamine tartrate intramuscularly in 1 cc. dose and thereafter resumed the use of her nicotinic acid and was given, in addition, a 50 mg. dose of pyribenzamine to take four times a day. There has been no recurrence since that time.

A 42-year-old woman had had intense pain for a period of two months. It extended from the right cervical area beneath the angle of the mandible to the temporal area well forward to the region above the right eye and postauricularly radiated downward to the trapezius. She had had treatment for sinusitis, including cocainization of the sphenopalatine ganglion on several occasions without relief. She had a normal neurological examination on two occasions. Neurological consultation was thought advisable because of the intensity of her head pain. A general physical examination had shown nothing worthy of remark. X-rays of the cervical spine and skull were normal.

Objectively the one finding of moment was a markedly dilated carotid bifurcation and dilatation and tenderness along the course of the superficial temporal artery, including its anterior temporal division. The course of the postauricular artery, as far as it could be palpated at sufficiently superficial point was tender as with the superficial temporal artery.

Questioning as to the precipitating cause demonstrated the fact that the patient had been confined to a small town for several months because of her husband's business and was under constant emotional stress because of her lack of ability to accept the change from the city. The nature of the origin of her pain was discussed with her, and with the combined use of nicotinic acid and pyribenzamine she obtained prompt relief and has had no recurrences since that time.

A 39-year-old woman suffered recurrent sore throats for a period of four years. The sore throat was usually unilateral, though the side frequently alternated. It was her impression that frequently the sore throats were precipitated by fatigue or by physical exposure — either occurring on a damp day or after exposure to drafts by a fan or air conditioning unit. She had an asthmatic mother and her father had had a constant catarrhal annoyance throughout the inclement period of the year for as long as she could remember. She, herself, had had seasonal pollenosis in her teens and recurrent migraine headache since 20 years of age. The sore throat which was her present primary complaint was never attended by fever, or other objective inflammatory sign, other than a regularly recurring gland-like tender mass beneath the angle of the mandible on the symptomatic side. She had had her tonsils removed two years previously without influence on her sore throat.

When examined during the acute phase of a typical episode of sore throat, it was noted that there was no evidence of mucosal inflammatory disorder. There was a moderate edema of the pharyngeal mucosa and the gland-like swelling was apparent in typical form. It was identifiable as the bifurcation of the carotid artery — a rather fusiform, pulsating, very tender swelling 1.5 cm. in diameter.

Abstinence from smoking with its vasoconstrictive influences, proper living routine and frequent use of oral nicotinic acid have lessened the frequency of sore throat to the point where it is an infrequent occurrence rather than a regularly recurrent annoyance. She still feels that imaginary tonsil tags underlie her disorder.

SUMMARY.

The character of an individual's autonomic nervous system is a matter of inheritance, hence autonomic imbalance tends to familial distribution.

Vasomotor control of the carotid arterial tree is vested in the autonomic nervous system.

The arteriolar periphery of the carotid ramifications is the important functional level. Spasm at this level occurs segmentally and results in capillary damage and edema distally and in angiodilatation proximally.

Angiodilatation of the carotid artery and its branches is a common cause of pain in the regions of the head and neck.

BIBLIOGRAPHY.

1. Abell, R. G., and Schenck, H. P.: *Jour. Immunol.*, 34:195-213, Mar., 1938.

2. Lewis, Thomas: The Blood Vessels of the Human Skin and Their Responses. Shaw and Sons Std., 1927.

3. Krough: The Anatomy and Physiology of Capillaries. Yale University Press, 1930.

4. Hooker, D. R.: *Physiol. Rev.*, 1:112-140, Jan., 1921.

5. Landis, E. M.: The Passage of Fluid Through the Capillary Wall. Harvey Lecture, Nov. 19, 1936.

6. Ratner, Bret: Allergy, Anaphyloxis and Immunitherapy. Williams and Wilkins, 1943, pp. 633-653.

7. Kuntz, Albert: Autonomic Nervous System. Lea and Febeger, 1945, pp. 494-495.

8. Burget, G. E.: Pathway for Visceral Afferent Impulses from the Forelimb of the Dog. *Amer. Jour. Physiol.*, 97:249-253, 1931.

9. Moore, R. M., and Moore, R. C.: Peripheral Course of Sensory Nerves Supplying Arteries of Lower Extremity. *Proc. Soc. Exp. Biol. and Med.*, 29:919-921, 1932.

10. Moore, R. M., and Singleton, A. G.: Studies on the Pain Sensibility of Arteries. II—Peripheral Paths of Afferent Nerons from the Arteries of Extremities and of the Abdominal Viscera. *Amer. Jour. Physiol.*, 104: 259-266, 1933.

11. Kuntz, A.: Nerve Fibres of Spinal and Vagus Origin Associated with the Cephalic Sympathetic Nerves. *Ann. Otol., Rhinol. and Laryngol.*, 43:50-67, 1934.

12. Hirsch, L.: Ueber die Nervenversorgung des Gefasse im Hinblick auf die Probleme der Periarteriellen Sympathktomis. *Arch. Klin. Chir.*, 137:281-288, 1925.

13. Woolard, H. H., and Phillips, R.: The Distribution of Sympathetic Fibres in the Extremities. *Jour. Anat.*, 67:18-27, 1933.

14. Woolard, H. H.: The Peripheral Sympathetic Nervous System. *Brit. Jour. Surg.*, 23:425-432, 1926.

15. Chorobski, J., and Penfield, W.: Cerebral Vasodilator Nerves and Their Pathway from the Medulla Oblongata. *Arch. Neurol. and Psychiat.*, 28:1257-1289, 1932.

CANCER OF THE NOSE: TREATMENT AND PLASTIC REPAIR.*

JOHN B. ERICH, M.D.,†
Rochester, Minn.

The treatment of external cancers of the nose is essentially the same as the treatment of skin cancers elsewhere about the face; however, there are two points of difference: First, unless extremely small, the removal of a skin lesion on the nose by excision leaves a wound which cannot be closed by primary suturing without causing unsightly distortion of the nose. Second, the margins of a recurring, postirradiated carcinoma are much less determinable on the nose than in most other situations about the face; this is so because the cancer cells tend to divide and spread along the periosteum or perichondrium under normal skin far beyond the apparent external limits of the growth.

Three factors lead to poor results in the treatment of cancer of the nose: First is insufficient or ineffective treatment by individuals who are completely ignorant of the nature of the lesion or who are inexperienced in the care of such growths. Second is incomplete treatment based on the fear of producing an external deformity. If cancers of the nose are going to be cured, deformities are bound to occur in a great many cases regardless of the type of treatment employed. Third is delay in radical removal of such growths until some conservative measure, such as the use of an escharotic or the use of a little Roentgen-ray or radium therapy, has first been tried.

*Read at the meeting of the Middle Section, American Laryngological, Rhinological and Otological Association, Inc., Iowa City, Iowa, Jan. 17, 1949.

†From the Section on Laryngology, Oral and Plastic Surgery, Mayo Clinic, Rochester, Minn.

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Such treatment not only may seriously change the rate of growth of the lesion but also may make the condition incurable; furthermore, it has been repeatedly demonstrated that

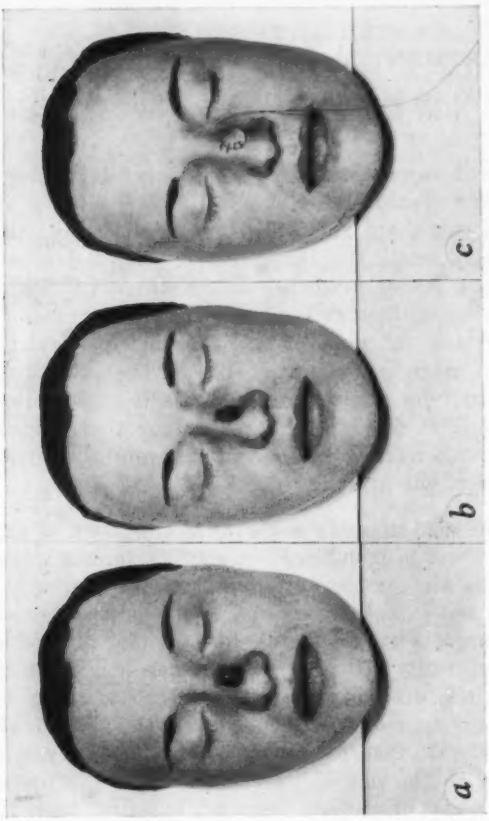

Fig. 1. Nasal skin flap and full-thickness skin graft for repair of small perforations of the nose. (a) Flap left attached along defect is elevated and sutured back. (b) Two weeks later, the flap is again elevated, turned over and into the defect as shown and sutured down around the edges of the defect to form a lining. (c) A full-thickness skin graft is obtained from behind the ear and is laid into the defect and over the flap.

inefficient primary treatment may actually raise the degree of malignancy of the tumor; for instance, many basal cell epitheliomas by such treatment are changed to more active squamous cell lesions.

I am not going to enter into a discussion of the relative merits of surgical measures and irradiation in the primary care of malignant tumors of the nose. Let it simply be said here, that regardless of what method is employed, let it be radical enough to cure the condition. There is only one good opportunity to effect a cure and that is at the time of the primary treatment. I should like to say, however, that a recurring carcinoma which has been previously treated by irradiation is not going to be cured by further irradiation; such cases should be considered as surgical problems without further delay.

Practically all malignant tumors involving the external nose are basal cell or squamous cell epitheliomas, and the former type occurs much more frequently than the latter. At the clinic, squamous cell epitheliomas are graded on a basis of 1 to 4, Grade 1 being the least malignant and least radiosensitive, and Grade 4 the most malignant and most radiosensitive. This form of grading is based on Broders' classification of the histologic appearance of malignant lesions and can be accomplished only by a competent pathologist. It is our opinion at the clinic that low grade lesions, which are more or less radioresistant, should be treated surgically; that is, either by surgical excision or the use of surgical diathermy (electrocoagulation). High grade lesions, which are extremely radiosensitive, are best treated by irradiation.

There is no one form of treatment which is suitable in all cases. The method of treatment should be in keeping with the type of growth that is present. Many physicians treat basal cell epitheliomas with success by irradiation; however, at the clinic, we prefer to remove them surgically, in the same manner as the low grade squamous cell epitheliomas are removed. A disc of tissue with a wide margin of normal tissue around the epithelioma is cut out. This is sent to the pathologist who freezes the tissue, makes slides and gives an immediate report. If the growth is low grade, if it has had no previous treatment, and if it has been removed with an adequate margin of normal tissue surrounding it, there is no

contraindication to an immediate repair of the defect. When the loss of tissue is extremely small, the edges of the wound often can be approximated without distorting the contour of

FIG. 2. Simple rotation of a contiguous nasal flap for repair of small perforations. (a) The flap is elevated, lined with a skin graft and sutured back in place. (b) Two weeks later, the flap is elevated, advanced and sutured around the defect. The lower part of the wound can be closed if a small triangular piece of skin is removed below the flap. (c) Final result.

the nose; however, most nasal wounds which follow the removal of a carcinoma are too large to be closed by simple approximation; instead, they require coverage with a free skin

graft. For this purpose, we usually employ a full-thickness skin graft from behind the ear, which has a better color and texture than skin grafts acquired elsewhere about the body.

If a low grade epithelioma on the nose is recurring and particularly if it has been treated previously by irradiation, it is very difficult to tell the exact extent of the growth because the cancer cells often spread along the periosteum or perichondrium far beyond the apparent limits of the tumor. Under such circumstances, the tumor should be removed widely by electrocoagulation. If surgical diathermy is used, the probability of the growth's recurring is much less than if sharp dissection is employed. Electrocoagulation leaves a sloughing wound which requires three or four weeks to heal; if the nasal bones are exposed, a sequestrum forms which must be removed in two or three months. The use of surgical diathermy for small epitheliomas on the nose often leaves a wound which heals with inconspicuous scarring; however, the removal of large malignant tumors cannot help but result in deformity of the nose.

An epithelioma of the nose which is extremely high grade is, in general, more satisfactorily treated by irradiation than by surgical measures. Such therapy consists in the insertion of radon seeds, the use of a radium plaque or Roentgen therapy.

The treatment of malignant tumors of the nose is bound to result in deformities in a great many cases. Such deformities may consist in conspicuous scarring, in a hole or perforation through the nose or in a loss of a large part of the nose. Patients often are embarrassed by such external deformities and are just about as eager to have the defect repaired as they were to have the malignant tumor cured. In most instances, we are of the opinion that plastic repair of defects of the nose which follow the removal of a malignant tumor should be deferred for at least one year after the treatment of the cancer. If after a year's time there is no recurrence of the lesion, it is fairly safe for one to proceed with plastic reconstruction.

Areas of dense scar tissue which are conspicuous often can be improved by excision of the main portion of the scar. This leaves a raw surface which must be replaced with a free skin graft, preferably a full-thickness skin graft from behind the ear.

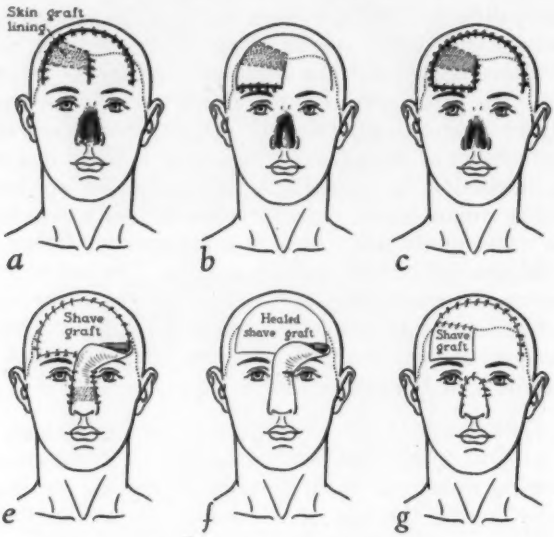

Fig. 3. Steps in the delayed elevation and transference of a loop-shaped supraorbital flap. (a) The flap is completely elevated and undermined as indicated by the solid lines. The dotted area represents a thick-shave skin graft which is inserted with its raw surface up to act as a lining when the flap is transferred to reconstruct the nose. After the lining is in place, the flap is sutured back in position as indicated. (b) Ten days later, one pedicle is cut across above the brow to stimulate the vessels in the remaining pedicle to become larger. The wound is sutured. (c) Ten days later, the entire pedicle flap is elevated and sutured back in position to stimulate the blood supply. (d) Ten days later, the flap is brought down and folded in such a manner as to form nostrils and a columella. The resultant denuded surface on the forehead is completely covered with a shave skin graft as indicated. (e) Two weeks later, the pedicle is cut half-way across as indicated and sutured back in position. (f) One week later, the pedicle is completely severed at the upper margin of the defect. The unused part of the flap is returned to the forehead after that part of the free skin graft which covers its bed has been excised.

Small defects involving the ala, columella or the free edge of the nostril can be repaired effectively by free composite grafts of skin and cartilage taken from the ear or by a wedge of tissue taken from the lobe of the ear. This technique

consists in excising a segment of the free border of the ear or the lobe and transferring this piece of tissue to the defect on the nose. Usually the defect must be changed by sharp dissection into a sort of wedge-shaped or rectangular loss of tissue, and the transplant from the ear must be inlaid into it. The use of free transplants from the ear is very satisfactory for small defects in the areas described, but this form of repair has a very limited degree of usefulness for defects following the removal of a carcinoma. This is so because the tissues adjacent to the defect have either been irradiated or are badly scarred; under either circumstance, the blood supply in the tissues is so poor as to prohibit the use of a free composite graft.

If the tissues around a defect have been irradiated or are badly scarred, one must resort to the use of a pedicle flap of skin if sloughing of the transplant is to be avoided. Shave and full-thickness grafts are completely detached from the donor site and maintain their viability only through the vascular supply of the bed of tissue in which they are placed. A transferred flap of skin, on the other hand, has its own blood supply through its pedicle, which is not severed until enough new blood vessels have grown between the edges of the defect and the graft to establish adequate circulation in the flap.

Two types of pedicle flaps can be employed for the correction of defects about the nose: simple or tubed. The simple "open" flap is constructed as a flat flap of tissue and usually is elevated in situations that permit direct transference of the flap to the defect. For repair of defects about the nose, such flaps usually are elevated either adjacent to the defect or on the forehead and scalp.

A tubed or "closed" flap of skin is prepared as a cylindrical structure with skin forming its outer surfaces, and fat its inner core. The process of tubing a flap of skin eliminates external raw surfaces when the flap is transferred, thereby preventing infections and scar tissue in the flap; moreover, tubing a flap increases its blood supply.

Before discussing the various types of simple and tubed pedicle flaps of skin which can be employed for the correction of defects about the nose, two factors should be considered:

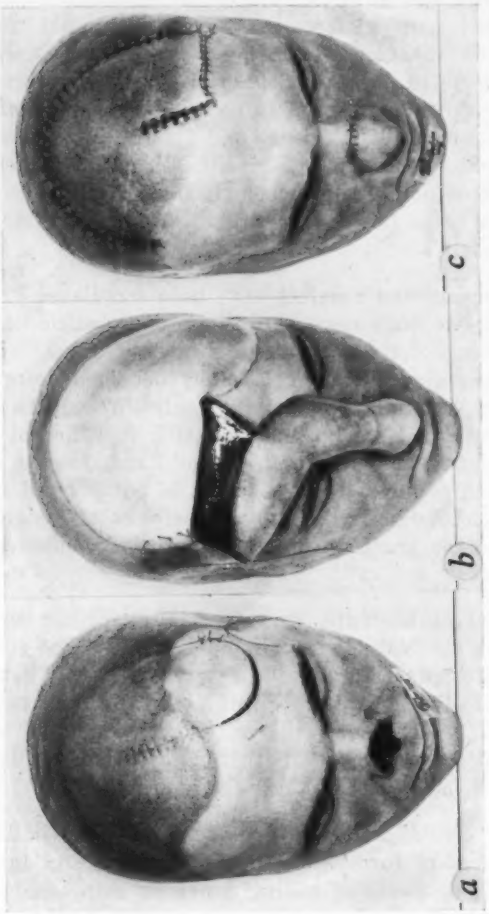

Fig. 4 (a) Midline sickle-shaped flap. (b) When the blood supply is adequate, the flap is brought down and folded to form nostrils and tip of the nose. The denuded surface on the scalp and forehead is completely covered with a shave skin graft as shown. (c) Three weeks later, the unused part of the pedicle flap is returned to the original donor site. Only a small part of the skin graft is visible on the forehead after the hair has grown out.

One is the need of an epithelial lining for many of these flaps. When a pedicle flap is employed to cover a perforation or

hole, that portion of the flap which covers the hole must be lined with skin; otherwise, the exposed raw surface of the flap covering the perforation will become excessively scarred, which causes distortion of the reconstructed part. There are three methods of lining a pedicle flap of skin: First, the distal end of the pedicle may be folded over on itself to form a lining. Second, a small flap of skin adjacent to the defect, with a pedicle along the free margin of the defect, can be turned into the perforation with its raw surface up to form a lining. This method cannot be used if the tissues adjacent to the defect have been irradiated or are badly scarred. The third and usual method of lining a flap of skin involves the use of a free skin graft which is inserted under that portion of the flap which will be used for the reconstructive process. Such a lining must be inserted under the flap at least two weeks before the flap is transferred.

The other factor which should be considered is the necessity of elevating most flaps in stages. Unless a flap is very short, with an extremely wide pedicle, it is likely to undergo sloughing if elevated and transferred in one operation. This difficulty can be eliminated if the flap is elevated in degrees, suturing it back in its original bed after each operation. By these surgical procedures, the vessels in the pedicle are stimulated to become larger until they are able to nourish the entire flap, which then can be transferred without danger of sloughing.

Three types of pedicle flaps of skin may be employed in the repair of defects about the nose: *1.* contiguous flaps, *2.* neighboring flaps and *3.* distant flaps. Contiguous pedicle grafts (see Figs. 1 and 2) are simple open flaps which are elevated in tissues immediately adjacent to the defect and are advanced or rotated to cover the defect. The contour and size of contiguous flaps vary according to the size, shape and location of the defect. Consequently, it is useless to attempt to discuss all of them or to classify them.

Neighboring flaps are pedicle grafts which are elevated in the same general anatomic region as the defect and are long

enough to permit direct transference to the defect. To repair losses of tissue about the nose, neighboring flaps usually are elevated on the forehead and scalp. My colleagues and I

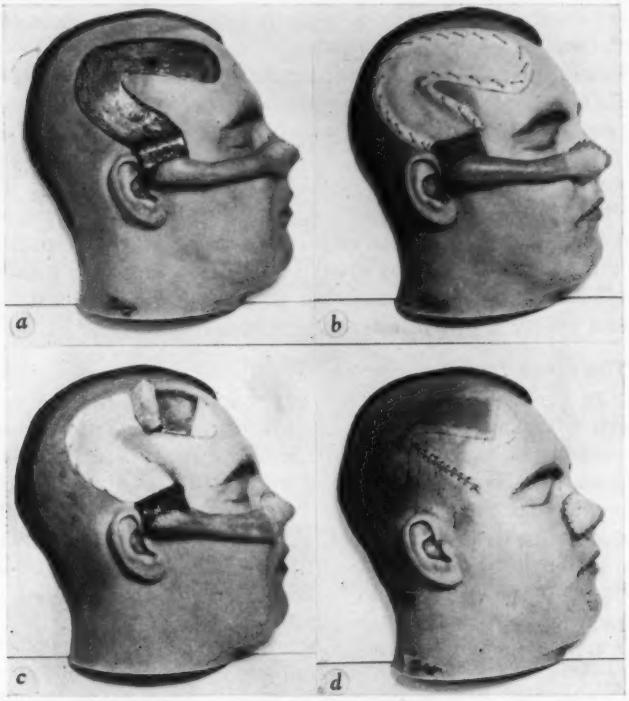

Fig. 5. Sickle-shaped temporal flap. (a) After elevating the flap in stages, the edges of the nasal defect are freshened; the flap is elevated and brought down so that its distal portion may be properly folded and sutured around the defect. (b) The denuded surface on the scalp is covered with a shave skin graft. The flap itself is wrapped in paraffin gauze to protect the eye from hairs, which grow from the hair-bearing part of the flap. (c) Three weeks later, the flap is severed from the reconstructed part and returned to the scalp. A part of the shave skin graft is removed so that the unused part of the pedicle can be returned to its original bed on the scalp. (d) The unused part of the flap has been returned to the scalp, leaving only a small part of the shave skin graft visible on the forehead.

employ three different types of neighboring flaps which make use of the skin on the forehead: *1.* the loop-shaped supra-orbital flap with a pedicle over one brow (see Fig. 3), *2.* the

midline sickle-shaped flap with a pedicle near the hairline (see Fig. 4), and *3.* the sickle-shaped temporal flap with a pedicle in the preauricular region (see Fig. 5).

Distant pedicle flaps are elevated in some anatomic region other than that in which the defect is located. A few of them will reach directly to the defect, but most of them can reach the recipient site only by migration or by the use of an intermediary, such as the wrist, which carries the flap to the defective part. For defects about the nose, we generally employ four types of distant tube flaps elevated either on the neck or chest; they are *1.* the cervical tube flap which is elevated usually along the course of the sternomastoid muscle (see Fig. 6), *2.* the clavicular tube flap which is elevated near the clavicle or directly across the clavicle (see Fig. 7), *3.* the chest tube flap which is elevated in a more or less vertical direction on the anterior chest wall (see Fig. 8), and *4.* the subaxillary tube flap which is elevated in a vertical direction on the side of the chest below the axilla (see Fig. 9). Only in rare instances do we employ distant flaps of the simple open type, such as a flap on the arm or an open flap on the chest, which is attached to the wrist.

As will be discussed, each group of flaps has certain advantages and disadvantages, and each flap in itself has one or more specific purposes. No single one of the flaps described is capable of correcting every type of defect about the nose.

For a small loss of tissue on the nose, contiguous flaps offer the quickest method of repair; moreover, their color and texture are the same as that of the rest of the face, since they are derived from the tissues adjacent to the defect. Contiguous flaps, however, have a very limited degree of usefulness, since they can be employed only for small holes or perforations and can be elevated only in tissues which have not been irradiated and which are not excessively scarred.

A small perforation on the nose can often be repaired quickly by means of a contiguous flap which acts as a lining and a full-thickness skin graft for a covering (see Fig. 1).

A small semicircular flap is elevated adjacent to the perforation in one or two stages. Eventually, it is turned with its raw surface up into the defect. Subsequently, the mucous

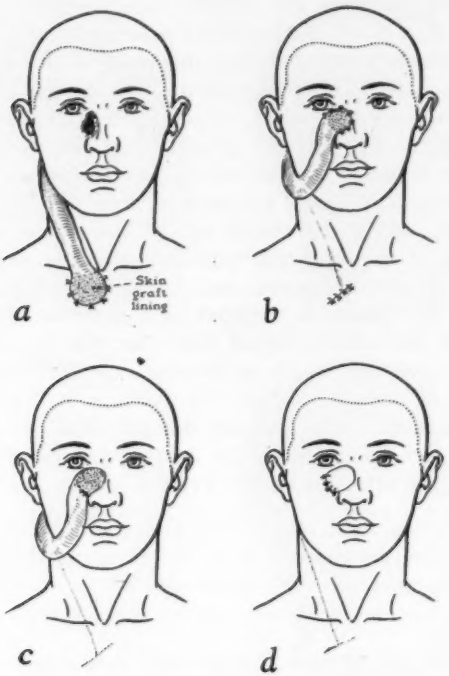

Fig. 6. Cervical tube flap. (a) The lower extremity of the tube flap which has previously been prepared is partially elevated and lined with a shave skin graft. The skin graft will form the lining for the reconstructed part. (b) Ten days later, the lower end of the cervical tube flap is elevated and attached to the margins of the defect on the right side of the nose. (c) Two weeks later, the tube is cut half-way across at the outer margin of the defect. This incision is sutured. (d) One week later, the unused part of the tube is detached from the reconstructed part and also from the neck and discarded.

membrane at the margins of the defect and the edge of the flap are sutured together. A full-thickness skin graft behind one ear is dissected and inlaid into the defect to make an epithelial covering.

If one wishes to avoid the use of an external full-thickness skin graft, the same type of perforation mentioned in the foregoing paragraph can sometimes be corrected by advancing a simple contiguous flap over the defect (see Fig. 2). The flap, however, must be lined with a free skin graft.

In general, my colleagues and I prefer to use a flap elevated on the forehead and scalp for the repair of all defects about the nose unless the forehead is scarred or unless the defect is small enough to be repaired by a contiguous flap. Forehead flaps require less time in preparation, they are less likely to slough, they offer less difficulty in preparation and give better cosmetic results than do any of the tube flaps; however, forehead flaps do have the distinct disadvantage of producing more or less conspicuous scarring on the forehead. This usually is of not great consequence in women, who can style their hair to cover the scarred area on the forehead, but in men it often is most undesirable. As previously stated, forehad flaps cannot be used when the skin in this region is scarred and they are of no use in a defect which requires fat as well as skin for reconstruction.

Generally we employ the sickle-shaped temporal flap for partial defects about the nose. The loop-shaped supraorbital flap and the midline sickle-shaped flap are reserved mainly for total reconstruction of the nose or for repair of the nasal tip.

The sickle-shaped temporal flap (see Fig. 5) is the most useful of the forehead flaps for repair of partial defects of the nose. This graft gives a very good cosmetic result and leaves less visible scarring on the forehead than is produced by any of the other forehead flaps. This sickle-shaped temporal flap can be extended back into the scalp to give it any desired length; it makes use of the bay of skin on the side of the forehead, which is the most inconspicuous area on the forehead. When this flap is transferred to a defect, and this applies to all of the forehead flaps, the denuded donor surface on the scalp and forehead is covered with a thin-shave skin graft. Such a free graft protects the denuded surface, and

Fig. 7. Clavicular tube flap for partial nasal defects. (a) A double pedicle flap of skin is elevated over or just below the clavicle and is tubed. (b) Four to six weeks later, the lateral end of the tubed flap is attached to the neck. (c) Three weeks later, the unused portion of the tube is cut off and discarded.

prevents infection and the development of granulations and scar tissue. Three weeks after the flap has been transferred, it can be cut across just above the reconstructed area and the unused part returned to the scalp. Before the pedicle can be sutured back in the original donor site, the underlying free skin graft must be excised.

Peculiarly enough, the donor area of a sickle-shaped temporal flap tends to shrink and contract, while the pedicle flap, after it has been transferred, tends to elongate. Consequently, when the unused part is returned to the scalp, its length appears to be greater than it was originally. As a result, only a very small amount of free-shave skin graft is left on the forehead.

The loop-shaped supraorbital flap (see Fig. 3) and the midline sickle-shaped flap (see Fig. 4) are usually well adapted for total reconstruction of the nose or reconstruction of the nasal tip. In both of these situations, the sickle-shaped temporal flap previously described is of no value. It does not supply enough tissue for the reconstructive process and it does not have sufficient length to reach the defect without placing undue traction and torsion on the pedicle. No flap is as satisfactory for total rhinoplasty as a forehead flap. The color, texture and thickness of the skin in this region is perfectly adapted for reconstruction of an entire nose. A forehead flap can be brought directly down to the nasal region and the distal extremity can be nicely folded to form a columella and nostrils. Only when the forehead is scarred would we consider using a tube or arm flap for total rhinoplasty. The color and texture of the skin in tube or arm flaps are poor, and the end of the flap, when transplanted to the nose, must be attached first over the bridge. This circumstance necessitates the construction of the columella and nostrils after the unused part of the flap has been cut off and discarded. It is rather difficult to fold properly the cut margin of the transplanted skin in an effort to make a columella and nostrils. Although we believe that a chest or subaxillary tube flap will not produce a completely satisfactory result, a total

nose constructed from an arm flap is even worse. Consequently, we would never consider the use of an arm flap for total rhinoplasty unless the forehead and trunk were scarred sufficiently to prohibit the elevation of a flap in one of these regions.

Fig. 8. Use of the upper end of a thoracic tube flap for nasal reconstruction because of the more satisfactory color. (a) The upper end of the tube flap is lined with a full-thickness or shave skin graft. This is indicated by the dotted area. (b) Later, the lower end is detached from the chest and sutured to the midcervical region. (c) When this has healed in three or four weeks, the upper end of the tube is cut across and elevated to the nasal defect.

For total rhinoplasty, a loop-shaped supraorbital flap (see Fig. 3) is the one that we usually employ; however, for any patient who has a very high forehead, a midline sickle-shaped flap (see Fig. 4) will construct a good nose with less notice-

able scarring on the forehead; the scarring, when this flap is used, is situated farther away from the eyebrow and consequently is less conspicuous.

It is well to remember that the average forehead is not sufficiently high to warrant the use of a midline sickle-shaped flap, which of necessity must be made longer than the more commonly used loop-shaped supraorbital flap. As a matter of fact, the forehead usually will afford no more than just enough tissue to construct a whole nose without including hair-bearing skin.

When merely the lower third or tip of the nose is lost, the midline sickle-shaped flap (see Fig. 4) is ideal because only a small amount of skin free of hair is necessary to reconstruct the lost portion of the nose. Under such circumstances, the midline sickle-shaped flap is to be recommended, since it will leave less visible scarring on the forehead than would a loop-shaped supraorbital flap.

These two types of forehead flaps require considerable time in preparation (see Fig. 3) and several stages in elevation in order to insure an adequate blood supply. The edge of the distal portion of the flap always is folded to form a columella and nostrils. By this process the lower half of the newly constructed nose is lined with skin. Whether or not the upper half needs to be lined with a free skin graft depends on the size of the nasal defect. If so, this free skin graft should be applied to the undersurface of the flap in the first stage of its elevation.

A reconstructed nose or nasal tip should be made somewhat larger than necessary to allow for subsequent shrinkage. Three to six months after the nasal reconstruction has been completed, the excess fat should be excised to effect a better contour. This can be accomplished by incising and undermining the skin over the dorsum of the reconstructed nose to permit removal of the excess fat over the top and sides. Later, excess fat around the nostrils can be removed through incisions along the lower border of the nostrils.

When the forehead or scalp is scarred, thus prohibiting the use of a forehead flap, tube pedicle flaps of skin elevated on the neck and trunk are by necessity required for the repair of many nasal defects. The one great advantage in a tube flap on the neck or chest or trunk lies in the fact that scarring at the donor site is not visible when the patient is clothed. Under ordinary circumstances, only one end of a tube flap is employed for reconstruction.

Fig. 9. Subaxillary tube flap. This is elevated in a vertical direction below the axilla and along the course of the thoracoepigastric veins.

Cervical and clavicular tube flaps (see Figs. 6 and 7) can be considered together because they are employed for the same purpose. They supply tissue for smaller defects about the nose. A cervical flap has the advantage of reaching directly to the defect, but has the disadvantage of leaving visible scarring on the side of the neck when the patient is clothed. On the other hand, a clavicular tube flap is too short to reach directly to the defect; one end must be attached to the side of the neck as an intermediary stage before the other end can be detached and transferred for the reconstructive proc-

ess. In consequence, a clavicular tube flap requires an extra four weeks' time in preparation. It has the advantage, however, of leaving no visible scarring when the patient is clothed, as does the cervical tube flap.

Chest tube flaps and subaxillary tube flaps (see Figs. 8 and 9) are used essentially for the same purposes. Each supplies a large amount of tissue, both fat and skin. A chest tube flap usually is employed in men. If possible, we prefer to use the upper end as it has a better color for nasal reconstruction; however, this necessitates bringing up the lower end of the chest tube and attaching it to the side of the neck; after four weeks the upper end may then be detached and used for repair of the nasal defect. A subaxillary tube rather than a chest tube is usually employed in women. A chest tube flap not only is difficult to elevate in women because of the breasts, but after elevation it produces considerable distortion of the breasts. In both men and women, the one great disadvantage of employing a subaxillary tube flap for defects about the nose is that it must be made very long and requires many stages in its elevation and transference to the nose. To shorten this period, one end of the tube can often be attached to the wrist, which acts as an intermediary to bring the tube directly to the nose; however, this technique usually is not advisable when the flap requires a lining, because this process necessitates too long a period of immobilization of the arm.

As previously discussed, the only instance in which we would employ an arm flap for repair of defects about the nose is in patients with scarring on the forehead, neck and trunk, a complication that prohibits the use of any forehead or tube flap. Arm flaps are composed of skin which lacks body and which is more likely to slough than the dermal tissue in any of the other pedicle grafts.

RECONSTRUCTION OF THE NASAL SEPTUM.*

D. M. LIERLE, M.D., and W. C. HUFFMAN, M.D.,†
Iowa City, Iowa.

The orthodox Killian submucous operation is fairly satisfactory for the deformities of the posterior or bony compartment of the nose but it is not adequate for dislocations and deformities of the anterior or cartilaginous compartment of the septum. Some of the objections are: *1.* It is not always adaptable in children. *2.* The removal of the most ventral portion of the cartilaginous part of the septum with high deflection and most caudal portion with anterior dislocation is not attempted because of the danger of resulting contraction causing saddling of the dorsum of the nose and distortion of the tip; consequently, these deformities are not corrected and the function is not restored as far as the pathways of the normal air currents are concerned. *3.* The removal of most of the cartilaginous and bony frame work of the septum often results in flaccidity and thickening of the soft tissues. The membrane is unable to resist intranasal pressures, and as a result there is distortion of the normal pathways of air currents. *4.* In a case of a twisted nose with deformity of the vertical buttress, failure to remove the buttress allows the obstruction to persist. *5.* There may be lacerations of the membrane with resulting perforations.

Metzenbaum made an attempt to overcome at least one of these objections; he attempted to replace the dislocated cartilage in the midline — thus relieving the obstruction without

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†From the Department of Otolaryngology and Oral Surgery, State University of Iowa, Iowa City, Iowa.

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endangering a dropped tip, retracted columnella, or saddling. He advocated, in principle, making an incision over the caudal end of the septum and elevating the mucous membrane on the opposite side. He then incised through just the cartilage posteriorly, freeing the caudal end from the soft tissues of the columnella. An incision was also made through the cartilage at the base. The only remaining attachment was above. Crosshatching of the deformed cartilage was sometimes necessary. Following this, the cartilage was placed in a groove made in the vomer and sutured in place into a new pocket in the columnella. This operation often failed in our hands as the cartilage frequently returned to the previous position; however, in some instances a satisfactory result was obtained.

The principle of removing the cartilage of the septum and replacing it between the mucous membrane is not new. The cartilage of the septum is nourished by imbibition of lymph and consequently it was thought that it was reasonable to expect that cartilage could be removed and replaced and still remain viable or at least remain long enough to prevent retraction.

The object of this paper is to evaluate fairly recent methods of correcting deformities of the cartilaginous part of the septum. These operations attempted to overcome the faults of the Killian operation. They have been described by Fomon and others. During the last seven years we have done over 200 operations involving the techniques described and have used both autogenous and homologous cartilage.

Analgesia consists of 1½ gr. of nembutal, 1/6 gr. of morphine sulphate and 1/150 gr. of atropine sulphate, 45 minutes previous to the operation. A solution of equal parts of 10 per cent cocaine and 1-1000 adrenalin is used for the block anesthesia; cotton-tipped applicators are placed in the region of the sphenopalatine ganglion, the internal nasal nerves and the foramen for the anterior palatine nerve. Following this, the soft tissues of the columnella and the septum are injected with a solution of 1.5 per cent monocaine with epinephrine

(1-30,000). In the event it is necessary to uncover the soft tissues of the nasal pyramid, additional analgesia is obtained by blocking with monocaine intranasally the infratrochlear, external nasal and infraorbital nerves.

The first operation was known as the "Galloway procedure" and briefly consists of *1.* removal of the deformed septal cartilage, trimming it so that it is straight, replacing it between the septal flaps, making a new columnellar bed, removing the nasal spine when necessary, drawing the cartilage down into this bed, and suturing it into place; *2.* the correction of the bony deformities involving the posterior or cephalic compartments. The technique of the Galloway operation is as follows:

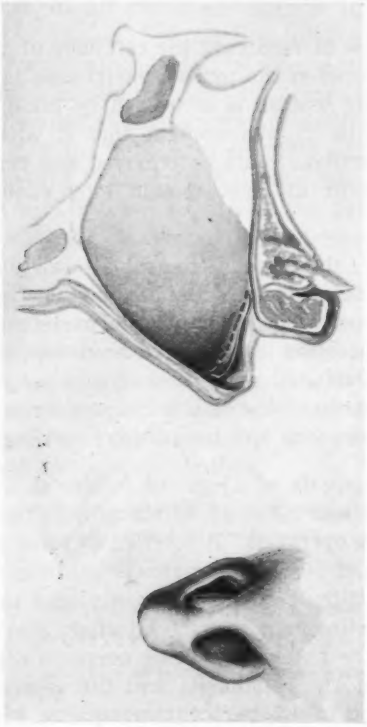

Fig. 1.

An incision is made along the projecting edge of the septal cartilage from front to back. If the mucoperichondrium is incised down to the cartilage throughout the length of the incision, all succeeding steps will be greatly facilitated (see Fig. 1).

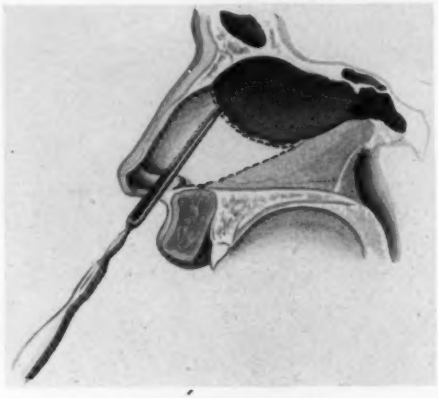

Fig. 2.

The operator now proceeds to elevate the mucoperichondrial flaps from both sides of the septum by any method to which he is accustomed. The extent of the elevation of the flaps on each side of the septum will naturally depend upon how much of the septum is to be removed. If a complete submucous resection is to be done — that is if there is obstruction in the posterior as well as in the anterior compartment of the nose— the entire skeleton of the septum is bared as in the usual operation.

If all of the cartilage has been removed, then the size and shape of the cartilaginous graft to be replaced is determined by measuring the distance from the lower edge of the nasal bones to the tip of the nose and from the nasal tip to the septolabial angle (see Fig. 3). In the majority of cases some cartilage can be left along the dorsum so that only the meas-

urements from the tip of the nose to the septolabial angle is of consequence. If necessary the nasal spine is removed at this time.

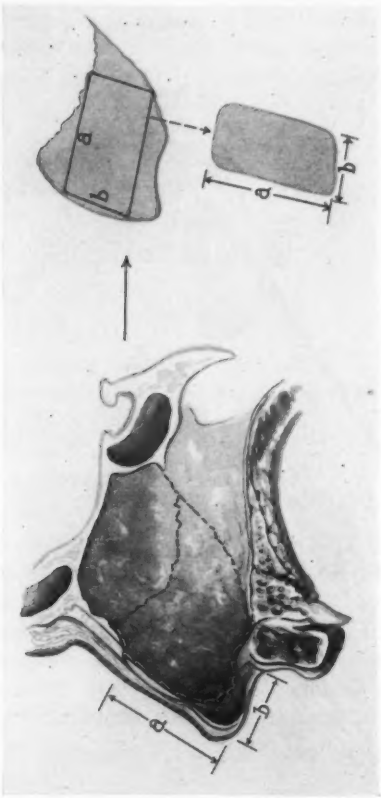

Fig. 3.

The removed septal cartilage is examined to find an area that is firm and straight. (If the septal cartilage that is removed is so fragmented or deformed and it is impossible to procure from it a graft of the correct size, it is permissible to use septal cartilage that has been removed from another

nose and preserved in merthiolate.) The measurements are laid out on any portion of the cartilage that meets requirements and the rectangular graft is excised.

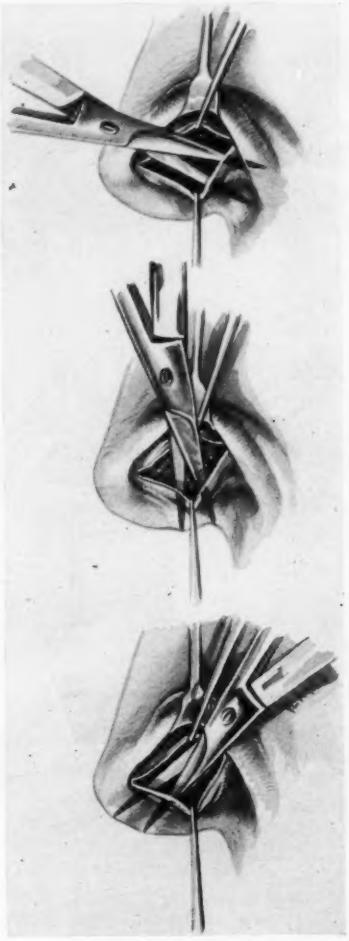

Fig. 4.

After excision of the graft, it is laid aside and a bed is made in the columnella to receive it. Either a scalpel or a pair of small scissors is introduced into the columnella by way of the original incision through the mucoperichondrium and a deep bed is dissected from the nasal tip to the nasal spine (see

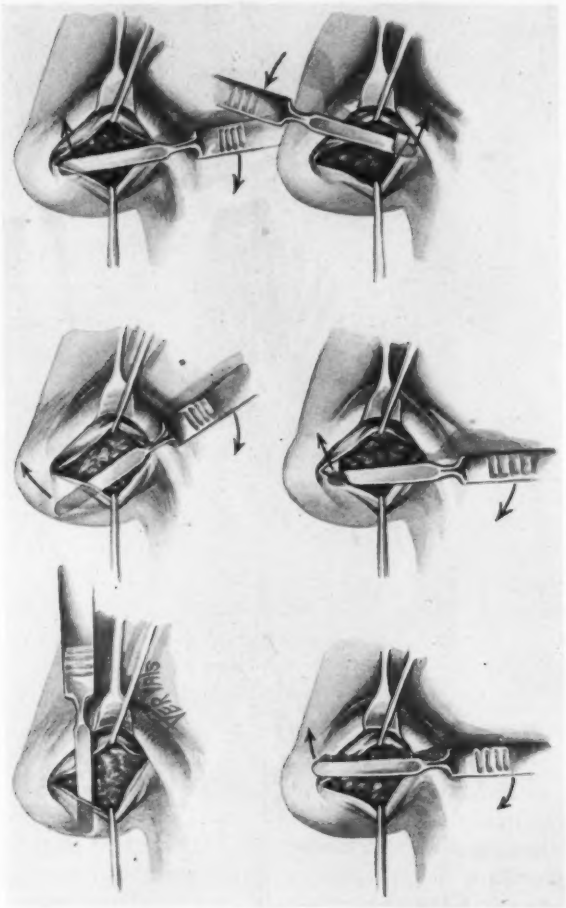

FIG. 5.

Fig. 4). Any fibrous strands connecting the two edges of the incision (preventing insertion of the graft) can be found by exploration with an elevator and then cut under direct vision (see Fig. 5) so that the incision opens into the columnellar bed along its entire length.

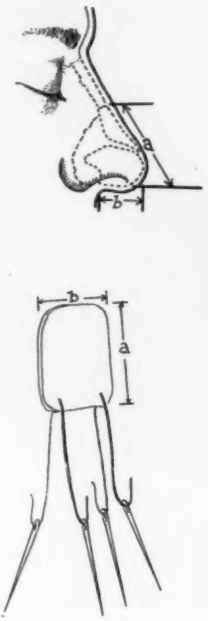

Fig. 6.

In order to facilitate handling of the graft, two double-armed silk sutures are passed through the end of the graft that is to fit into the columnella (see Fig. 6). The cartilage is grasped with a pair of forceps and inserted between the septal flaps.

After the cartilage is between the flaps, the double-armed silk sutures are passed through the original incision into the columnellar bed and are pushed through the columnella, being

brought out on its under surface (see Figs. 7 and 8). The two sutures are used to draw the graft down into its bed in the columnella and to hold it in place while fixation sutures are being passed (see Fig. 9).

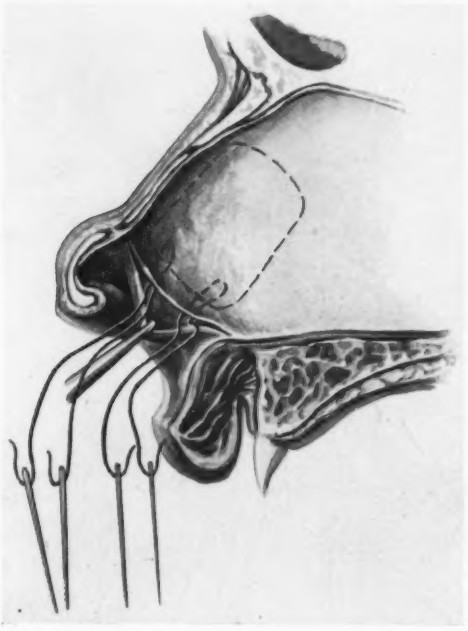

Fig. 7.

While the graft is held firmly in the columnellar bed by means of the temporary sutures previously passed through the graft and out through the columnella, the final sutures are passed (see Fig. 10)—one posteriorly and one anteriorly. Each suture is started above the incision and passed through the septal flap, through the graft, through the opposite septal flap, and then is brought back through the columnella below the incision.

The temporary sutures are removed and the septal flaps are

firmly packed against the cartilage graft with vaseline gauze. Unless there are signs of interference with drainage, these packs are left in place three or four days. The two silk sutures are removed on the seventh or eighth postoperative day.

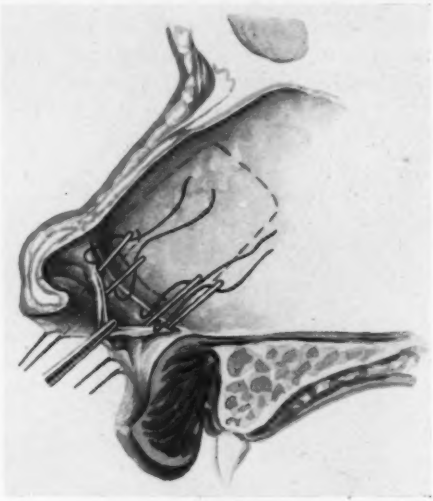

Fig. 8.

As a matter of routine, the patient is kept on full doses of penicillin for seven postoperative days.

The technique of the second or Fomon operation is briefly as follows: *1.* The membranous septum on the right side of the septum is incised throughout its length by a Bard Parker Knife, No. 15, and a new bed is created by separating the laminae of the columnella with a Bard Parker knife and Stevens scissors; a batten of cartilage (2 to 5 mm. in width and 2.5 to 3 cm. in length) is inserted between the flaps of the columnella and fixed in place by two through and through silk mattress sutures behind the cartilage. This cartilage is not intended to act as support, but mainly adds stiffening to the columnella and keeps it from retracting. *2.* A transfixion is done by cutting the opposite membrane with a knife, and

the remaining membranous septum is cut by straddling and holding the scissors perpendicular to the nasal spine. *3.* The caudal end of the septum is trimmed with a knife, the soft

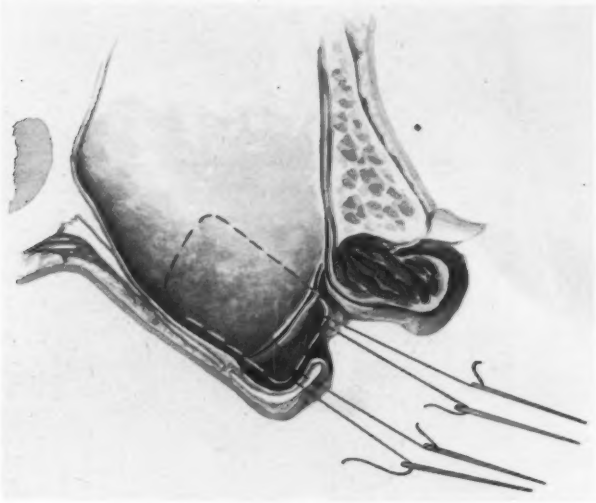

Fig. 9.

tissues elevated on both sides for a short distance, and a curved needle with heavy silk is passed through the caudal end of the membrane on either side above and below. The suture ends are grasped with a hemostat and thrown over the side of the face to act as retractors. *4.* The membrane is elevated over the cartilage and bone in the usual manner, and the obstructing cartilage is resected with scissors and/or a swivel knife as far ventrically, cephalically and dorsally as is necessary, again leaving some of the cartilage along the dorsum. At this time deviations of the vertical plate may be corrected and spurs of the vomer may be removed along with the nasal spine when necessary. The deformed cartilage is trimmed so that it is straight, is reinserted between the flaps and held in place by through and through silk mattress sutures. If it is necessary to use a number of smaller pieces of cartilage (see Fig.

10), the nose is first packed on both sides with vaseline gauze and the pieces of cartilage are held in place by the pack. The cartilage of the patient should be made usable by trimming, shaving or cross-hatching if possible. If not, cartilage preserved in merthiolate is used. 5. The nasal fossae are firmly packed with vaseline gauze to apply moderate pressure on the membrane to the cartilage grafts and to prevent the formation of hematomas. The packs are removed on the fourth day and the sutures from the fifth to the seventh day.

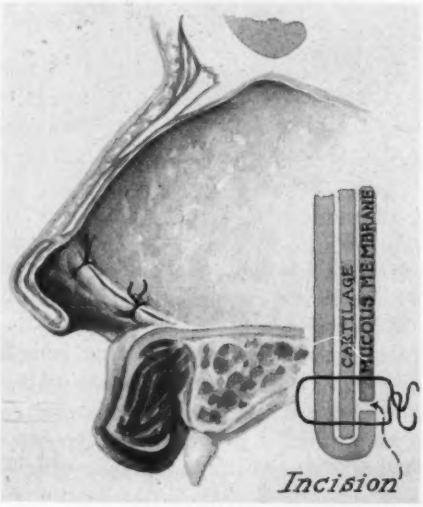

Fig. 10.

Frequently obstructing septums are associated with external nasal deformities. These external deformities should be corrected not only for aesthetic reasons but also to improve the function of the nose. It is quite obvious that a thickened columnella, an old fracture or a recessed tip due to a short columnella, etc., may interfere with the intake of air and cause abnormal deviation of air currents.

Most authorities feel that when septal and external deformities are both present it is preferable to do the septal surgery first and to correct the external deformities later. Although in general this is a safer procedure, we have done both procedures at the same time and have had no complica-

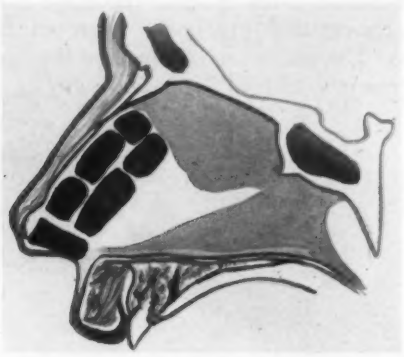

Fig. 11.

tions; however, if this is done, there should be a definite order of procedure: *1*. The soft tissues over the nasal pyramid are elevated. *2*. The profile projection is reduced. *3*. The batten is placed in the columnella. *4*. Following completion of the transfixion, the septal cartilage is removed and the obstruction of the septum corrected. *5*. The upper lateral cartilages are cut from the septum and trimmed when necessary. This step is done following the resection of the septum because the attachment of the upper laterals to the septum furnishes stability — thus making the resection easier. *6*. The osteotomy is done and the nose is narrowed. *7*. The lower lateral cartilages are freed and delivered and trimmed if necessary. *8*. Finally, the battens of cartilage are placed between the septal flaps. *9*. The nose is packed.

DISCUSSION.

The statement has been made that the septum under static conditions does not furnish support to the nasal pyramid but

merely acts as a reserve safety factor. It is claimed that the entire quadrilateral cartilage can be removed without danger of collapse of the nasal pyramid at the time of operation. Generally speaking, this may be true, but we have seen a number of cases of saddling immediately following the removal of the entire cartilaginous septum. There is a weak point of the dorsum caudal to the attachment of the upper lateral cartilages to the nasal bones. This area varies in extent due to the fact that at times the upper lateral cartilages swing away from the septum at an unusually high level cephalically. Saddling may occur here at the time of removal of the cartilage in the region of the lower lateral cartilages when the cartilages are under developed or soft in texture. In most instances some of the cartilage along the dorsum may be left, but if it is necessary to remove all of the cartilages in a twisted nose — then the operator must have enough experience in rhinoplastic surgery to repair the saddling defect.

One of the chief objections to the Galloway operation is that replacement of the cartilage as a single plate, which is drawn into a deep columnellar pocket, leaves the columnella and membranous septum more or less immobile. In a few cases the immobility will lend a certain "frozen" or stiff appearance to the nasal lobule. This may be obviated to a certain degree by making the pocket more cephalically and not drawing the septal cartilage so deeply into the columnella. The Fomon operation eliminates this complication by utilization of the cartilage as several grafts — one narrow strip in the columnella and several small plates between the septal flaps.

In a comparatively small percentage of cases when one plate of cartilage is used and only one unilateral incision is made, there may be buckling or drawing of the cartilage to one side, causing varying degrees of obstruction. This is thought to be due to unequal scar contraction because of the unilateral incision and to the lines of contracture during the healing converging toward the center of the single graft. The second, or Fomon, operation eliminates this complication by virtue of the

transfixion; in addition the lines of contraction between the healing septal flaps are broken because of the multiple battens of cartilage.

There has been absorption of cartilage in a few cases —particularly when homologous cartilage was used; however, such cartilage has remained *in situ* long enough in every instance except one to prevent contractions of the tip and saddling of the dorsum.

The Fomon operation has proved to be more satisfactory in the majority of cases because it overcomes the complications of the frozen, stiff nose and eliminates buckling or bowing of the cartilage.

Most of us in the past have had failures in improving breathing with the orthodox submucous operation. We have corrected fairly satisfactorily deformities of the vertical plate and vomer, but we have neglected to open the front door of the nose. It is quite obvious that to improve nasal function deformities of the anterior cartilage and certain external deformities must be corrected. It is our opinion that the principles of these operations are correct but much remains to be done in perfecting them. The entire septum should be removed only in those cases where there is definite deformity of the dorsum of the septal cartilage, such as in the twisted nose. This operation implies that the operator must have a thorough knowledge of rhinoplastic procedures and be able to cope with any situation which may present itself. If there are no complications other than the simple dislocation of the anterior cartilage, then the average rhinologist with some training could and should be able to correct the deformity.

BIBLIOGRAPHY.

1. FOMON, SAMUEL, and Associates: Plastic Repair of the Obstructing Nasal Septum. *Arch. Otolaryngol.*, 47:7-21, Jan., 1948.

2. METZENBAUM, MYRON: Asymmetry of the Nares. *Arch. Otolaryngol.*, 16:690-697, Nov., 1932.

3. METZENBAUM, MYRON: Dislocation of the Lower End of the Nasal Septal Cartilages. *Arch. Otolaryngol.*, 24:78-88, July, 1936.

THE USE OF THE MAGNET IN THE TRACHEOBRONCHIAL TREE, THE ESOPHAGUS, STOMACH AND DUODENUM.*†

MURDOCK EQUEN, M.D.; GEORGE ROACH, M.D. (by invitation), AND ROBERT BROWN, M.D. (by invitation),
Atlanta, Ga.

Electromagnets have long been used in the extraction of metallic bodies from the eye. Shortly after World War I, Jackson, Tucker and Clerf used such a magnet to dislodge a bullet from the upper lobe of a veteran's lung and bring it down to a main bronchus from which they removed it with forceps. Electromagnets, however, have seldom proven useful in endoscopic work.

In 1943, the General Electric Company perfected a permanent magnet for practical use in endoscopy: A cylinder of fused aluminum, cobalt and nickel, small enough to be passed through a bronchoscope, it needed no batteries or wiring. In 1944, the senior author reported its use in the removal of an open safety pin from the esophagus, before the Southern Medical Association. It is our purpose here to review the application of this magnet.

In cases of doubt as to whether the foreign body will respond to the magnet, one may employ an adaptation of the "mine detector" so extensively used in the recent war. The Berman locator (manufactured by the Waugh Laboratories, a subsidiary of the General Electric Company) will settle the doubt in a few minutes.

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†From the Ponce de Leon Ear, Nose and Throat Infirmary.

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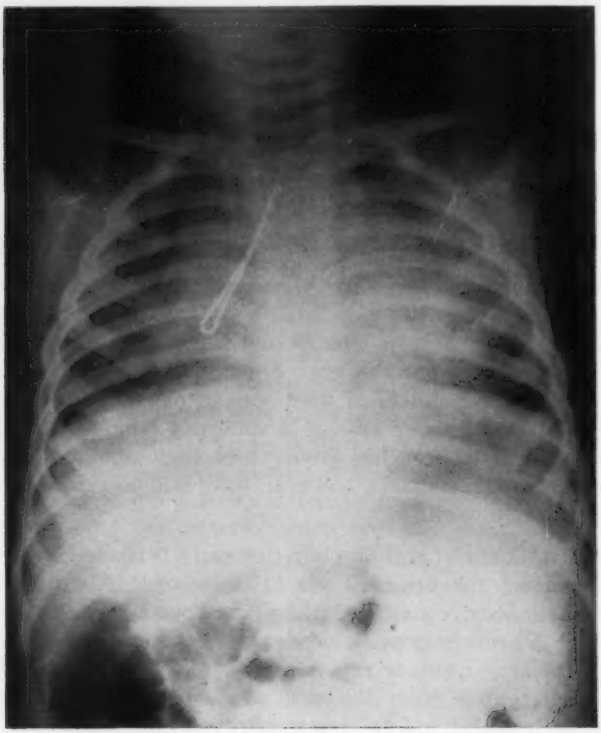

Fig. 1. (A) The bobby pin in the infant's trachea and right bronchus. (Case 1).

TRACHEOBRONCHIAL TREE.

Of course, many metallic foreign bodies can still be removed with forceps from the trachea or larger bronchi. Sometimes, however, an ordinary straight pin will drop down the tracheobronchial tree almost to the diaphragm. When the pin (or any other object) becomes lodged in a bronchiole it is most difficult to grasp it with forceps. Passing a small bronchoscope as near it as possible under the guidance of a biplane fluoroscope enables one to push a small magnet near enough

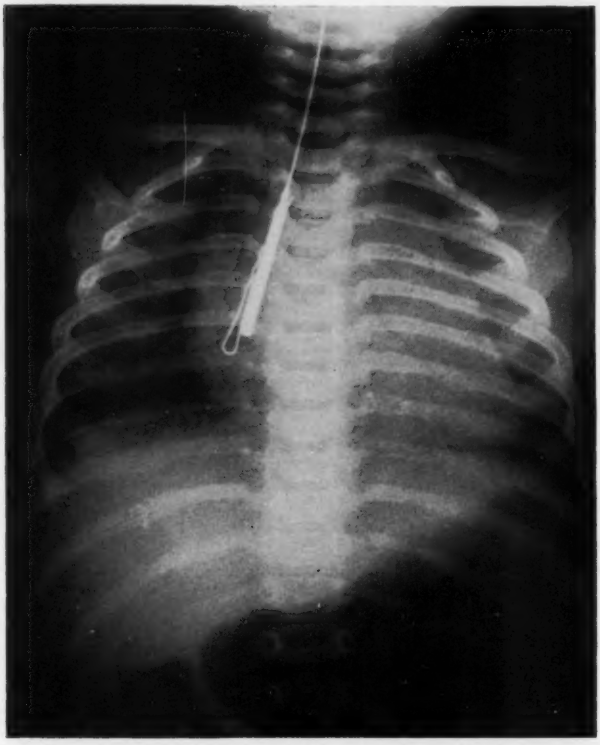

Fig. 1 (B) Its magnetic withdrawal (Case 1).

to attract the pin. Such a case was reported before this Society three years ago. The patient went home well two days later.

Even when the foreign body can be picked up with forceps, however, it is simpler merely to insert a laryngoscope, lifting up the epiglottis, and to push the magnet fused onto a ureteral catheter into the trachea. This involves no trauma to the trachea. Occasionally, it is true, the vocal cords will strip the foreign body from the magnet and then it can be quickly picked up with forceps.

Case 1: Gerald, aged seven and one-half months, was playing with his mother's purse when a bobby pin slipped out. The baby placed it in his mouth and, in swallowing it, made a noise that caused his mother to turn around. He vomited a few times but then appeared all right. He was taken to his family physician, who secured an X-ray. This revealed the bobby pin in the lower trachea, extending down into the right main stem bronchus. Though the bobby pin is not considered a large object, the plate (see Fig. 1, A) shows that in this infant's chest it appeared enormous. Within an hour of its aspiration, the bobby pin was removed with a small lung magnet. Three days later, Gerald went home well without even having had an elevation of temperature.

It may be remarked that the use of the magnet (and the model best suited to the individual case must be used) does not render less necessary experienced skill on the part of a surgeon specializing in endoscopy, and of his assistants, including the anesthetist and Roentgenologist; nor does it obviate the need for a full armamentarium of instruments of varying sizes.

THE ESOPHAGUS.

Swallowed coins will usually pass through the gastrointestina tract uneventfully. This case is an exception to the general rule.

Case 2: Jean, aged seven years, was playing with a large Italian coin, the size of a half dollar, her father had brought home as a souvenir of his fighting overseas. She put it in her mouth and unintentionally swallowed it. After that she suffered constant distress and could swallow only liquids. Five days after swallowing the coin she was brought to the Ponce de Leon Infirmary where X-ray revealed the coin caught in the lower third of the esophagus. To our great relief the Berman locator buzzed loudly as it was brought over the chest. (Mussolini did not use silver or copper to make coins during the war; indeed, in 1944 our own government minted pennies of iron.) The child was anesthetized, and through an esophagoscope the magnet was passed. Contact was established and the coin quickly extracted. It was fortunate that it did not remain longer in the esophagus, for examination after the coin had been removed revealed beginning pressure necrosis.

Because babies have the inveterate propensity of putting into their mouths everything they can get hold of, because they are brought up amid safety pins and because their mothers forget the importance of leaving no open safety pins within a baby's reach, one of the most common foreign bodies found in a baby's esophagus is an open safety pin, with the point up. When an open safety pin is found in the esophagus,

the surgeon has few choices: *1.* it may be possible to close the pin *in situ*, and then to remove it, but at best this causes considerable trauma to the organ; *2.* the pin may be cut in two and removed piecemeal, but this is a traumatic business; *3.* the pin may be grapsed by the spring with a forceps and

Fig. 2. (B) The pin is being withdrawn point up, nonmagnetic head trailing (Case 3).

pushed down into the stomach. Once in the stomach, sometimes the surgeon can reverse it and withdraw it, the point trailing; more often, however, he will lose his hold on the pin and he will have to call on a general surgeon to remove it through an abdominal incision, a formidable procedure in a baby.

The fourth and simplest method, providing only that the safety pin is of steel, is to use a manget. Several such cases have already been reported from the Ponce de Leon Infirmary.[2]

A magnet of suitable size is attached to a Levin tube, which encases a semiflexible wire, and which is attached to a hand bellows. The magnet is passed down the esophagus, dragging the safety pin with it, the point harmlessly trailing, into the stomach. The stomach is then inflated with the hand bellows and the magnet manipulated under fluoroscopic guidance until the safety pin is reversed. Magnet and pin are then drawn back up the esophagus without injury and the baby is often sent home well the following day.

THE STOMACH.

Though adults occasionally swallow the most extraordinary objects, most metallic foreign bodies in the stomach have been swallowed by children. The first thing to do is to determine if the foreign body has passed beyond the pylorus. If the X-ray is taken with the child lying on his back and the stomach inflated, the spinal column projects upward and the lowest part of the stomach is the fundus. If the foreign body lies in the fundus, particularly if several plates show some difference in its position, one can be sure it is in the stomach. If, however, all plates show the foreign body across the spinal column or to the right of it, it is probably in the duodenum. For intragastric work we use a magnet on a semiflexible wire with a Levin tube as just described. A curve in the magnet enables the operator to have better control of it. Sometimes, however, we are content to use a magnet tied to a string.

Here are a couple cases of some unusualness.

Case 3: Dorothy, a young lady of six, primping for a dance and trying to decide where to place the bouquet her date's mother had sent her, swallowed the corsage pin. Considering the dance the most important thing in her life — social life begins early in Atlanta — she did not tell her parents of the accident until she came home from the party four hours later. She was brought to the Ponce de Leon Infirmary at 10 p. m.

X-ray revealed the pin in the stomach. The stomach was inflated and the magnet brought out point first. The child went home well 36 hours later.

Fig. 2. (A) The corsage pin in the stomach of a child of seven (Case 3).

Case 4: Five-year-old William was a carpenter's son. Playing with his father's tools, he swallowed a staple. Though free of symptoms, he was sensible enough to tell his father, who brought him at once to the infirmary. About half an hour after he swallowed the staple, X-ray revealed it in the stomach (see Fig. 3, A). This two-pronged staple was too dangerous to leave there, so it was at once removed with a magnet, the bend of the staple up, the points trailing. The boy went home two days later.

THE DUODENUM.

Prior to May 7, 1947, when a metallic foreign body had passed the pylorus, the attending physician had his choice of watchful waiting or of submitting the patient to the hazardous operation of duodenotomy. While, of course, many such objects do pass on through the gastrointestinal canal without

Fig. 3 (A) The staple in the little boy's stomach (Case 4).

causing any symptoms, in our opinion if it has a point or a sharp, ragged edge it is best to try to remove it at once from above; or if the object is relatively long and observation for a few days indicates that it will not get by the ligament of Treitz, every effort should be made to extract it with a magnet.

At the 1947 meeting of the American Medical Association we claimed that the first removal of a metallic foreign body from the duodenum from above had been performed at the Ponce de Leon Ear, Nose and Throat Infirmary on May 7 of

Fig. 3. (B) The staple is being withdrawn. As with open safety pins, it was necessary to be sure that the staple was attached to the magnet so that the points would trail (Case 4).

that year. The report was published in the *Journal of the American Medical Association*[3] a few months later, and the claim has not been challenged. Six additional cases have been seen by us since. In two the foreign body had become so fixed in the duodenum that it was impossible to dislodge it and the children were submitted to an open operation. Although both finally recovered, the seriousness of their courses made us more enthusiastic than ever about removal of such objects with the magnet. The second[4] and third[5] cases successfully treated have already been reported, and the fourth will be.

Here is the fifth case of magnetic removal of a foreign body from the duodenum at our infirmary, which is probably the fifth case in history:

Fig. 4. (A) The shadow of the bobby pin lies across the spine (Case 5).

Case 5: Sandra was six. Two days before admission to the infirmary at 10 p. m., she had swallowed a bobby pin. Although she was experiencing no symptoms, X-ray revealed the bobby pin in the third portion of the duodenum. Her jaws were held open with a gag, and a magnet, tied to an opaque string, was pushed digitally into her esophagus. She was then given a soft drink which carried it into her stomach. Her arms were immobilized in cardboard splints to prevent her pulling it out, and a special nurse kept her mostly on her right side during the night to secure the aid of gravity in getting the magnet by the pylorus.

Sometimes the patient reports that he feels a click inside that denotes the contact has been established between the magnet and the foreign body. In this case, however, we did not learn of the contact until an X-ray was secured at nine the next morning. The child was promptly

Fig. 4. (B) Lateral view with barium in the stomach proves that the pin is in the duodenum (Case 5).

anesthetized to secure relaxation and, while she was under the fluoroscope, gentle traction was exerted on the string. When the magnet and foreign body were in the stomach, an esophagoscope threaded around the string was inserted and the withdrawal completed. The child was sent home well two days later.

The original technique of removing metallic bodies from the duodenum has been altered in two respects. A radio-

opaque string, prepared for us at the Georgia Institute of Technology, is, we believe, helpful in enabling us at all times to find out the position of the string. The esophagoscope pre-

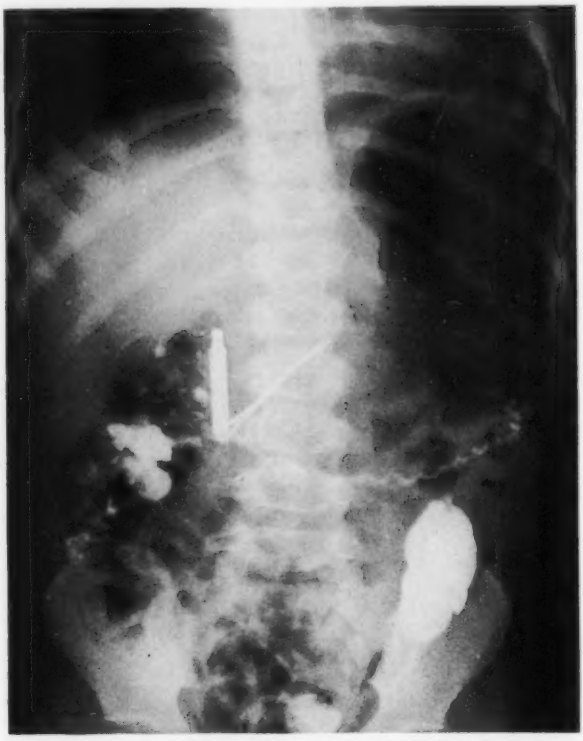

Fig. 4. (C) Nine hours later the magnet has met the bobby pin in the stomach. The opaque string can be seen along the greater curvature of the duodenum (Case 5).

vents trauma in the esophagus and also prevents stripping the magnet of the foreign body at the cricopharyngeal constriction.

SUMMARY.

Five years' experience with the alnico permanent magnet (sometimes as a cylinder fixed to a rather rigid ureteral

catheter, and thin enough to pass through a 4 mm. bronchoscope; sometimes as a stubby curved affair tied to an opaque string; sometimes with other modifications) have convinced us that it provides the quickest and safest, the least traumatic method of removing ferrous foreign bodies from the lungs, esophagus, stomach and duodenum. It is the easiest and surest way to remove such objects from the stomach and the only way — short of a serious open operation — that they can be removed from the duodenum.

REFERENCES.

1. JACKSON, CHEVALIER: Magnetic Aid in the Bronchoscopic and Esophagoscopic Removal of Foreign Bodies from the Air and Food Passages. *Ann. Otol., Rhinol. and Laryngol.*, 37:435, June, 1928; also, *Proc. Amer. Bronchoscopic Soc.*, 1927.

2. TUCKER, GABRIEL: A Flexible Gastroscopic Forcep with Magnetic Tip. *Tran. Amer. Broncho-Esophagological Assn.*, p. 17, 1946.

3. HOLINGER, PAUL H.: Magnets for Extraction of Foreign Bodies from Air and Food Passages. *Tran. Amer. Broncho-Esophagological Assn.*, pp. 18-19, 1946.

4. EQUEN, MURDOCK: Magnetic Removal of Foreign Bodies from the Food and Air Passages Under Fluoroscopic Guidance. *South. Med. Jour.*, 38:245-246, Apr., 1945.

5. EQUEN, MURDOCK: Magnetic Removal of Foreign Bodies from the Food and Air Passages. *Arch. Otolaryngol.*, 46:225-229, Aug., 1947.

6. EQUEN, MURDOCK; GILLIAM, ROBERT, and LINEBACK, MERRILL: Nail in Duodenum Removed by Magnet. *Jour. A. M. A.*, 135:432, Oct. 18, 1947.

7. EQUEN, MURDOCK: Foreign Bodies in the Duodenum. *South. Med. Jour.*, 41:187-191, Mar., 1948.

8. EQUEN, MURDOCK: Foreign Bodies in the Duodenum and Magnetic Influence in Bronchoscopy. THE LARYNGOSCOPE, 58:726-734, July, 1948.

STAPEDIOPARALYTIC PHONOPHOBIA ("HYPERACUSIS") IN A DEAF EAR.

Case Reports Including Studies on the Analysis of the Phenomenon and Suggestions for Possible Applications of the Phonophobia Test.*

KURT TSCHIASSNY, M.D.,
Cincinnati, Ohio.

THE FUNCTION OF THE STAPEDIUS MUSCLE.

For about a century the protection of the inner ear was regarded to be the function of the stapedius muscle. J. Mueller,[1] in 1943, wrote that the influence of this muscle in hearing is unknown. "The only effect which it appears to me could be ascribed to it could be to render tense the membrane by which the base of the stapes is connected with the margin of the fenestra." Erhard,[2] in an address presented at the meeting of the Berlin Medical Society (1868), said definitely: "If Mr. von Troeltsch calls the tensor veli palatini on account of its action the abductor tubae, one could call the tensor tympani the compressor cavitatis and the stapedius muscle the tutor labyrinthi." Although the majority of investigators adhered to the protection theory, there were a few authorities (Lucae,[3] Hitzig,[4] Urbantschitsch[5] and others) who attributed to the middle ear muscles the particular auditory function of adjusting the tension of the eardrum and ossicular chain to the varieties of pitches. The stapedius muscle sometimes was even considered to be "the muscle of listening." The action

*From the Department of Otolaryngology, University of Cincinnati College of Medicine.

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of the two muscles was regarded as antagonistic; one of them contracting on lower notes, the other one on higher notes, and relaxing vice versa.

This concept was first disproved by Toru Kato's[6] animal experiments in 1913. He demonstrated that weak stimuli do not change the condition of the muscles. Stronger stimuli produce appropriate contraction of the stapedius muscle. Increasing intensities are accompanied by contraction of the tensor. Exceedingly strong stimuli effect a tetanic contraction of both muscles. These reflexes are dependent on the integrity of the inner ear. They appear bilaterally on unilateral stimulation. They disappear when the inner ear is destroyed. Kato came to the conclusion that by contraction of these muscles diminution of the amplitude of the vibrating structures is achieved and the impact onto the labyrinth diminished. This concept was particularly supported by the observation of the more rapidly developing damage to the cochlea with acoustic traumatization in those cases in which these muscles were paralyzed and inactivated experimentally; therefore, both of them are to be regarded as synergistic protectors of the labyrinth: the stapedius reflex being the more sensitive reaction appearing first, while the tensor reflex appears in addition when activated by stronger stimuli.

Luescher[7] (1929) was the first to study the stapedius reflex in man by direct observations through a dry perforation in the upper superior quadrant by means of an ear microscope. He observed the reflex with stimuli of between 90 dv. and 14,000 dv. Noises were even more effective than pure tones. There was no reaction to whisper. Smaller intensities produced only a brief contraction. This cochlear-stapedius reflex was elicited by stimuli applied to either ear and appeared even as a psychic reaction when the patient anticipated a stimulus. Tactile stimuli applied to the external ear at areas supplied by the third cervical nerve effected a moderate reaction. Luescher[7] came to the conclusion that in the "centripetal portion of the reflex arch the nervus cochlearis occupies the first position, whereas sensory receptors play a minor rôle, if

any at all." The theory that stapedius contraction increases the hearing acuity appears definitely disproved. The muscle is shown to contract only on acoustic stimuli of higher intensities; therefore, it acts as a damping mechanism.

Luescher's observations were confirmed and enlarged upon by extensive studies of Kobrak,[8-9] particularly in cooperation with Lindsay, Perlman, Dubner[10-12] and by others. These authors used for their studies, besides Luescher's method, a technique described by Kobrak.[8] An "optic perforation" was obtained by artificially making the eardrum translucent. Measuring quantitatively the threshold of the stapedius reflex relative to the threshold of hearing at the various frequencies, they found a striking parallelism between the two curves. The reflex was proved to depend definitely on the function of the cochlea. It appeared equally on crossed and uncrossed stimulation. It was restricted in cases of bilaterally impaired hearing; it appeared also on stimuli applied by bone conduction, and was abolished with general anesthesia.

PHONOPHOBIA.

Paralysis of the stapedius muscle is associated with a painful sensation in the ear of the paralyzed side when strong acoustic stimuli are applied.

According to W. Erb,[13] this phenomenon was first observed by Roux in his own case and became well known through Landouzy's treatise (1851). Credit is paid to the same author by Hitzig[4] and by Bazire.[14] A discussion of the various concepts on the mechanism of the phenomenon as was presented by authorities such as Hitzig,[4] Lucae,[3] Brown-Sequard,[15] Urbantschitsch[5] and others, being only of historical interest, shall be omitted. Erb[13] deserves credit for introducing this symptom as a diagnostic aid in localizing the site of the lesion in instances of facial nerve paralysis.

The terminology of the phenomenon was frequently changed (Gruenberg[16]), as mentioned by the writer[17] in a previous article, "It was sometimes called 'hyperacusis'; but as has

been repeatedly observed, this term is rather incorrect, since there is no increased acuity of the organ of hearing, but only increased sensitivity for auditory stimuli. For this reason, terms such as hyperesthesia acustica, hyperalgesia acustica, hyperesthesia dolorosa, dysacusis have been recommended. Obviously none of these terms is quite appropriate. In my opinion, this phenomenon represents a close analogy to the ophthalmic phenomenon which is characterized by 'photophobia.' The irritating factor in the case of the eye is light [Greek: phos(phot); in the case of the ear, sound (Greek: phone)]. Accordingly, I take the liberty to suggest the use of the word 'phonophobia' for designating the symptom of hypersensitivity for auditory stimuli."

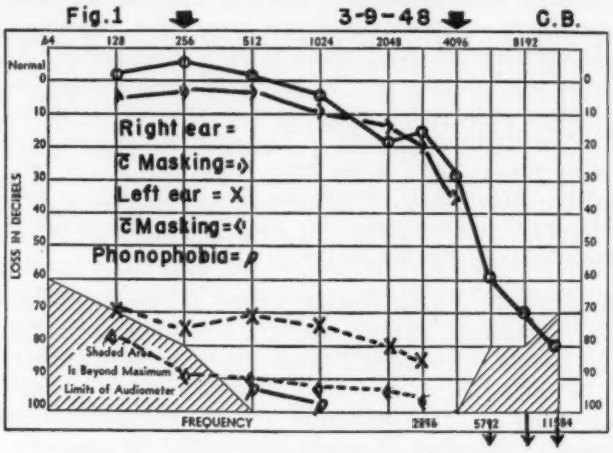
Hyperacusis or phonophobia, as the author wishes to call it now, represents, in other words, a depression of the threshold of feeling below normal levels; however, such a condition can be caused by a variety of factors besides neuropathic inactivation of the stapedius reflex (Politzer,[18] Urbantschitsch[5]); therefore, it might be justified to designate the type observed in association with Bell's palsy as "stapedioparalytic phonophobia" (S. P. P.).

The recent advances of our knowledge on the function of the stapedius muscle aroused increased interest in studies of this symptom. Perlman[19] reported interesting observations obtained by his studies on the phenomenon in a case of Bell's palsy. He found particularly increased fatigability, enlarged masking effect, and delayed recovery time on the paralyzed side in comparison with the normal. The curve of phonophobia threshold paralleled the curve of hearing threshold. The former appeared at levels such as are known to represent the threshold of stapedius contraction when stimuli are applied under normal circumstances.

AUTHOR'S STUDIES.

The rare coincidence of Bell's palsy in a patient with unilateral complete deafness involving the side of the deaf ear

presented to the writer the occasion for some observations and studies by which additional information on the subject was obtained.



Case 1: Chester B., age 42, colored, factory worker, came on March 19, 1948, to the ear, nose and throat clinic for left facial paralysis which he had noticed for two days. The condition was preceded by some pain and dullness on the paralyzed side. He never was sick before, except for an injury in the neck suffered in a fight 25 years ago. He had been completely deaf in his left ear for 22 years. Deafness resulted from target shooting, which he practiced when serving in the National Guard. Examination revealed a complete paralysis of the left facial nerve involving its entire distribution. There was marked Bell's phenomenon, normal lacrimation, and absence of taste sensation for all four qualities on the left anterior part of the tongue. Marked phonophobia was manifested when, at the frequencies of 512 dv. and 1024 dv., intensities above 90 db. and 95 db., respectively were applied. When these intensities were induced, the patient immediately removed the receiver from the ear, saying: "It hurts!" The phenomenon was sometimes to a milder degree present at 2048 dv. and was absent at higher frequencies and at those below 512 dv., even when the strongest intensities were applied. Weber to the right, Schwabach shortened, Rinne positive on the right, no air conduction on the left. Audiometric as shown in the chart (see Fig. 1). The hearing curve of the left ear was obviously "shadow" hearing, since the threshold was considerably raised with masking of the right ear. Practically no change in the hearing threshold of the right ear was brought about by masking the left ear. Lombard's test was definitely positive. Accentuated loud voice *ad aurem* was not heard when the right ear was masked. The left ear appeared to be completely deaf. Eardrums were normal. Nose and throat normal. Vestibular examination revealed no spontaneous manifestations and normal caloric reactions equal on both sides.

Course: Vitamin B complex was prescribed and massage and heat applications recommended. The patient was seen again on March 9, 1948, and on March 17, 1948. On these and on subsequent occasions the studies were performed which are reported in detail below. The condition gradually improved. Bell's phenomenon disappeared. Taste returned. Phonophobia, however, persisted at the frequencies of 512 dv. and 1024 dv. On March 31 there was only a slight weakness on closing the eyes and on whistling. Phonophobia was still present. Patient did not keep appointments and was seen again only on July 14. There was present only a slight weakness involving the mouth branch. Testing for phonophobia, however, revealed definite pain sensation with application of intensities above 90 db. and 95 db. at the frequencies of 512 dv. and 1024 dv.

THE PROBLEM.

Presence of hypersensitivity for auditory stimuli in the absence of any ipsilateral auditory function was regarded as a rather paradoxical phenomenon. The problem in this case revolved about the question: What is the neural mechanism responsible for phonophobia in a deaf ear?

In planning the search for the analysis of the problem, the following four explanations were considered:

I. Phonophobia might have been present in a latent state preceding the, and entirely independent of the, facial paralysis. It might be the manifestation of a psychic factor conditioned years ago when the patient experienced the damage of his left ear caused by strong auditory sensations.

II. It might be caused by the stapedius paralysis of recent origin and activated by auditory stimuli applied to the deaf ear, but perceived in the opposite ear by the mechanism of "shadow hearing."

III. The phenomenon might not depend on hearing at all, but might be caused by vibratory sensation of tactile character, the threshold of feeling being depressed by paralysis of the stapedius muscle. Lierle and Reger[20] have shown the threshold of feeling to be about equal in a deaf ear to that in a normal ear.

IV. The phenomenon might depend on the joint influence of both factors.

EXAMINATIONS.

With these considerations in mind, a series of studies was performed on March 17 and some on later occasions.

1. The patient was asked whether he ever experienced discomfort in either one of his ears with loud sounds or noises of any kind at any time before the onset of Bell's palsy. The answer was definitely no.

2. The threshold of phonophobia was determined at the left (deaf) ear by suddenly releasing the sound interruptor at various frequencies and intensities. It appeared to be at a level somewhat above 90 db. and 95 db. when frequencies of 512 dv. and 1024 dv. were applied.

3. Application of maximum intensities at those or other frequencies at the right ear was only felt as "awfully loud." No pain at either ear was noticed.

4. The masking buzzer was applied to the right ear while phonophobia was tested for at the left ear in the manner described under 2. Patient, as a rule, manifested phonophobia. He noticed pain and sometimes almost reflexly removed the sound receiver; however, his responses appeared somewhat inconsistent. For this reason the arrangement of the experiment was changed when it was repeated at a later occasion. This time both receivers were first applied simultaneously, while the intensities at the critical frequencies were increased gradually. No phonophobia was manifested this time even at the highest possible intensities; however, when the examiner himself suddenly removed the masking receiver, phonophobia of shock-like character appeared instantly.

5. This was abolished immediately by placing the masking buzzer back again.

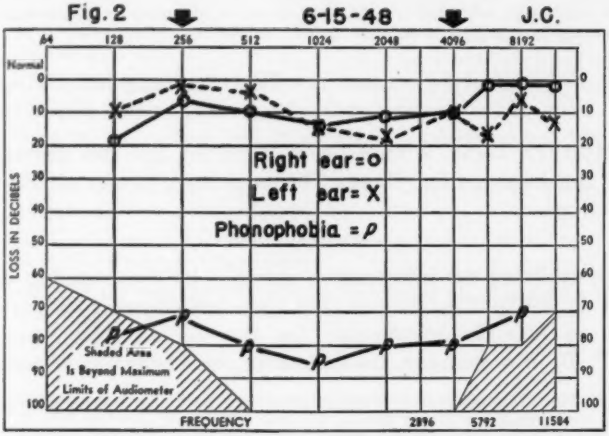
6. Sensory stimuli of nonacoustic character such as produced by pressure changes in the external meatus by means of Siegle's otoscope, by blowing air at the structures of the external ear and at the eardrum, and by syringing the ear canals, did not produce phonophobia. No difference was felt when these procedures were performed alternately on either side.

7. Bonain's solution was instilled in the left ear. On examination for phonophobia after 10 minutes the phenomenon was still present. The patient could not tell of any difference in the intensity of the pain; however, he noticed some undeterminable changes in its location.

8. Ten per cent cocaine solution was insufflated by means of a Eustachian tube catheter. No particular discomfort was produced by this procedure except for a "lump in the throat." When, after several minutes, he was tested for phonophobia the phenomenon appeared to be completely abolished even when the strongest intensities were applied to the paralyzed side.

9. There was no change after 10 minutes. After 20 minutes when the test was repeated, a sort of "ticklin" was felt; after 30 minutes S. P. P. returned with the same character and intensity as before.

Another case of Bell's palsy associated with S. P. P. in a patient with bilateral practically normal hearing, observed only recently, was the occasion for repeating the above mentioned studies.



Case 2: Joanne C., age 18 years, came to the ear, nose and throat clinic on June 15, 1948, for right facial paralysis, present for about one week. Previous history was noncontributive. Patient was in her ninth month of pregnancy. Examination revealed all branches of the VIIth nerve on the right side were involved. Bell's phenomenon present. Taste absent. Lacrimation present. Hearing almost normal on both sides (see Fig. 2). S. P. P. appears over all frequencies at levels between 55 db. and 70 db. above and to some extent paralleling the curve of hearing threshold.

Course: Vitamin B complex was prescribed and massage and heat application recommended. The condition improved rapidly. After one week motion in the upper portion of the face returned. Bell's phenomenon disappeared. S. P. P. appeared to be less pronounced. Some taste was present. On June 30, phonophobia test revealed no discomfort on any frequency even when highest intensities were applied. July 18, delivery. July 25, S. P. P. absent. Taste normal. Considerable weakness at the oral branch still present.

EXAMINATIONS.

On June 18, identical studies as outlined in the first case were performed. The results were practically the same except for the following differences:

1. On masking the opposite ear, the threshold of S. P. P. was practically the same as without masking.

2. On insufflation of cocaine solution, S. P. P. disappeared only for 15 minutes; however, the possibility of a smaller amount of cocaine having been applied this time cannot be ruled out.

3. Subsequent to cocaine insufflation a temporary diminution of the hearing at the lower frequencies was noticed.

Most of these studies were watched by the residents, Dr. Deishley and Dr. Hogg. The cases were presented at staff meetings.

CONCLUSIONS.

In applying the information obtained by these studies relative to the four conditions that were considered to represent factors possibly responsible for the neural mechanism of S. P. P. in a deaf ear, the following conclusions are justified.

I. The possibility of a pyschic factor can be discarded on account of examinations 1 and 3.

II. Unimpaired "shadow hearing" by means of the opposite ear represents an integral factor in activating the phenomenon. Evidence obtained by examinations 2, 4 and 5.

III. Unimpaired tactile sensitivity of the ipsilateral middle ear structures for acoustic stimuli represents an integral factor in the phenomenon, whereas it is practicaly not influenced by tactile sensation of the external ear, including the external surface of the eardrum. Evidence obtained by examinations 6, 7, 8 and 9 and confirmed by examinations in Case 2.

IV. Accordingly, the joint presence of both factors, unimpaired hearing in the opposite ear and unimpaired tactile sensitivity of the ipsilateral middle ear structures represents the requirements for possibly activating the neural mechanism responsible for S. P. P. in a deaf ear. With absence of either one of these two factors, S. P. P. is abolished.

Among the possibilities considered previously, condition IV represents the answer to the problem at issue.

COMMENTS.

New Information Resulting from These Studies:

Several new pieces of information on the subject of S. P. P. are apparent from these studies in the reported two cases.

1. S. P. P. is observed in a case of complete inner ear deafness on the paralyzed side with normal hearing in the opposite ear. The phenomenon appears practically restricted to the frequencies of 512 dv. and 1024 dv. with application of intensities of 20 db. to 25 db. above the "shadow" curve.

2. S. P. P. is abolished with masking the opposite ear. By this procedure the "shadow" curve at the critical frequencies is raised to such levels that the maximum increase of available intensities is less than 10 db.

3. S. P. P. reappears momentarily with removing the masking receiver from the opposite ear.

4. Masking the opposite ear in a case of bilateral normal hearing hardly influences the threshold of S. P. P.

5. Stimuli of nonacoustic character applied to the external ear do not elicit S. P. P. in either case.

6. With anesthetics applied to the external surface of the eardrum, S. P. P. persists in either case.

7. With 10 per cent cocaine solution insufflated via Eustachian tube, S. P. P. is abolished in either case.

8. The phenomenon reappears after a period of time apparently coinciding with the disappearance of the cocaine effect.

9. In general, S. P. P. appears to be dependent on the joint presence of two factors: *a*. normal hearing present at least on one side, and *b*. unimpaired tactile sensitivity of the middle ear structures on the paralyzed side.

10. With interference with either one of these two factors, the phenomenon is abolished.

CONDITIONS RESPONSIBLE FOR THRESHOLD OF S. P. P. COMPARED WITH THOSE CONTROLLING THE THRESHOLD OF FEELING.

S. P. P. represents a depression of the individual threshold of feeling due to the absence of the protective stapedius reflex. There are, however, some principal differences between conditions controlling the threshold of S. P. P. and those responsible for the common threshold of feeling. Fundamental information on the latter subject was presented by Lierle and Reger.[20]

1. Threshold of feeling was shown by these investigators to be independent from the condition of the cochlea, being practically the same in a deaf ear as in a normal ear. Contrariwise, S. P. P. is definitely dependent on the threshold of

hearing, as was repeatedly demonstrated, and even on the threshold of the "shadow" curve, as was observed in the present study.

2. Threshold of feeling depends in various ways on the condition of the eardrum; *e.g.*, it is raised in cases of hypoesthesia of the membrane. Contrariwise, anesthetics applied to the external surface of the eardrum evidently do not change the threshold of S. P. P.

CONDITIONS IN S. P. P. COMPARED WITH THOSE IN STAPEDIUS REFLEX.

There exists a considerable analogy between conditions responsible for the stapedius reflex and those involved in the threshold of S. P. P.

1. The threshold curves were shown to be practically equal for both phenomena (Perlman[19]).

2. Both are definitely related to the threshold of hearing.

3. General anesthesia abolishes the stapedius reflex (Lindsay, *et al*). Likewise, anesthetics topically applied to middle ear structures abolish S. P. P. (present study); however, S. P. P. and stapedius reflex differ from each other insofar as the former can be elicited exclusively by ipsilateral stimulation, whereas the latter appears equally on uncrossed and crossed stimulation.

ANALOGY BETWEEN STAPEDIUS REFLEX AND PUPILLARY LIGHT REFLEX.

By implication of a possible analogy with the pupillary light reflex one could use the terms "direct" and "consensual" reaction, respectively. To the writer, the concept of an analogy with the pupillary light reflex appears to be supported by an interesting observation reported by Kobrak.[9] This author, in a case of unilateral complete deafness with some hearing in the opposite ear, has seen stapedius contraction

occur in the deaf ear when stimuli were applied to the opposite ear; however, no contraction was seen to occur when equal stimuli were applied to the deaf ear.

This observation suggests to the writer a striking analogy with the conditions involving the pupillary light reflex in the case of a unilateral optic nerve lesion.

EFFECT OF ANESTHESIA ON THE STAPEDIUS REFLEX AND ON S. P. P.

A. General Anesthesia.

Lindsay, *et al.*,[11] as mentioned already, observed the stapedius reflex to be abolished with general anesthesia. In the writer's opinion, the mechanism of this effect may be explained in either one of two ways.

1. By paralysis of the stapedius muscles incapacitating the effector organ (efferent branch of the reflex arch).

2. By abolishing hearing, incapacitating the receptor organ (afferent branch of the reflex arch). The possibility of sensory receptors of so far unknown location, representing a component in the afferent branch, must be theoretically considered.

Accordingly, frustration of stapedius muscle contraction may be explained in the first assumption by inability of the muscle to contract when stimulated; in the second assumption, by absence of stimulation, although the muscle is able to contract.

Of course, the possibility of both factors, the effector organ and the receptor organ to be incapacitated, must be considered.

B. Local Anesthesia.

Krassnig[21] claims paralysis of the tympanic muscles to be effected by instillation of 10 per cent cocaine solution into the tympanic cavity; however, he does not offer observations upon which his statement is based. Disturbance of taste,

changes in pupillary reaction, bradycardia, labyrinthine symptoms and lengthening of bone conduction, as mentioned by this author as occurring subsequent to cocaine instillation, cannot be regarded as signs sufficient for indicating tympanic muscle paralysis.

Information regarding the effect of locally applied cocaine on the stapedius reflex has not yet been presented.

EFFECT OF LOCAL ANESTHETICS ON S. P. P.

By the present studies the definite information was obtained that cocaine insufflated into the Eustachian tube abolishes S. P. P. The writer is not in the position to offer a definite explanation on the mechanism responsible for this effect. Two possible modes of action may be considered:

1. Cocaine causes anesthesia of the peripheral neural receptors (of undetermined location) responsible for the pain manifested in S. P. P.

2. Cocaine inactivates the peripheral neural receptors responsible for initiating the stapedius reflex. Pain such as caused by stapedius paralysis when its contraction is called for, may probably not appear under a condition such as not to necessitate the action of the muscle in its capacity as "tutor labyrinthi."

Future investigation may possibly reveal information about the influence of cocaine on the stapedius reflex by direct observation through an open or "optical" window.

In the writer's opinion, investigations to this effect seem to be of considerable importance. A clear cut understanding of all the factors responsible for the mechanism of S. P. P. is the prerequisite for a possible clinical application of the phonophobia test.

Observation of the presence or absence of direct and/or consensual reaction associated with or without phonophobia could provide appropriate information.

TECHNIQUE OF THE PHONOPHOBIA TEST.

To the author, the test appears to include necessarily two parts:

A. Determination of the threshold of pain (if any) manifested on sudden release of the interruptor at the various frequencies.

B. Determination of disappearance or persistence of phonophobia subsequent to cocaine insufflation. In the case of persistence some extratympanic factor should probably be considered as responsible for the phenomenon.

SUGGESTIONS FOR PRACTICAL APPLICATIONS OF THE PHONOPHOBIA TEST.

I. As a Possible Support in the Diagnosis of Otosclerosis.

As mentioned already, hypersensitivity for acoustic stimuli is observed to occur occasionally in conditions other than Bell's palsy. In this concern, Politzer[18] writes: "Hyperesthesia acustica is a painful sensation in the ear which is produced by tones and noises and which is also found in persons of normal hearing when the highest tones are elicited near the ear. Anemic, nervous, hysterical, etc., persons are often unpleasantly affected by certain tones and noises. This painful perception for noises is a symptom which frequently accompanies hemicrania, trigeminal neuralgia and a beginning or developed cerebral affection. . . . Hyperesthesia acustica is, however, most often met with in acute and chronic affections of the middle ear and labyrinth, especially in the severe form of otosclerosis. In these cases the sensitivity for noises is often disproportionate to the disturbance of hearing as it has frequently been found that when there is complete deafness there is still hyperesthesia acustica."

Urbantschitsch,[5] presenting a rather comprehensive casuistic from the literature and from observations of his own, emphasizes differentiation between real hyperesthesia acustica on one hand and a condition merely characterized by discomfort and pain for loud noises and sounds on the other hand. "In these cases the increased sensitivity does not involve the acoustic nerve but the sensory nerves and only appears to be

activated by acoustic stimuli. It may occur even in deaf people, particularly when produced by sounds close to the border of the hearing field. Talking with loud voice into the ear of those patients produces a minor auditory, but a distinct pain sensation."

One may easily conceive that in some of these conditions mentioned by Politzer and Urbantschitsch a latent stapedial dysfunction may possibly play a rôle as a causative factor (Potter[22]).

In the writer's opinion such a hypothesis when restricted to the case of otosclerosis appears to be based not merely on speculative grounds. In this connection, attention may be called to the microscopical findings in the middle ear muscles as obtained by D. Wolff[23] in four cases of otosclerosis. In all four cases these muscles appeared to be atrophic.

Correlation of the observations mentioned by Politzer and Urbantschitsch with the histological findings of Wolff reveals a new aspect for a potential contribution to the symptomatology of otosclerosis by methodical application of the phonophobia test.*

It is self evident that only systematic investigations performed on a large scale of normal and pathological cases of all varieties can determine the value (if any) of this test as a procedure providing probable diagnostic support in cases of questionable otosclerosis.

II. As a Sign Indicating Diminished Natural Protection of the Inner Ear.

A positive phonophobia test might indicate loss or diminution of the action of the stapedius muscle in its capacity as "tutor labyrinthi."

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*In the writer's opinion, Wolff's findings represent also a new concept for a possible explanation of the still debated mechanism of Hyperacusis Willisii which has been shown to be rather a pseudo-hyperacusis.

Disturbed function of the muscle might not necessarily be based on conspicuous neuropathic conditions as in the case of Bell's palsy, but possibly on myopathic changes as demonstrated by Wolff in cases of otosclerosis.

Presence of phonophobia should never be neglected but rather be regarded as an alarming signal calling for appropriate precautions. Similarly, as paralysis of the orbicularis palpebrarum muscle demands artificial protection of the eyeball, phonophobia demands it for the inner ear.

Testing for phonophobia appears advisable to be instituted as a routine procedure in any case of Bell's palsy. For the duration of the phenomenon, patients should be advised to use routinely some sort of sound protectors, particularly when exposed to strong acoustic stimuli by professional or circumstantial factors.

It might also be justified to introduce the phonophobia test as a part of routine examinations performed by those responsible for the welfare of industrial workers and employees, and probably also by those working in induction boards of the armed forces.

Kato's experiments demonstrating the rapid destruction of the cochlea when it is deprived of its muscular protectors should be kept in mind. Informative instructions and protective measurements provided in time might possibly prevent irreversible damage.

SUMMARY.

Protection of the inner ear as the function of the stapedius muscle appears definitely proved.

Its paralysis is frequently associated with Bell's palsy, and manifests itself by hypersensitivity for loud acoustic stimuli at the paralyzed side. This phenomenon previously designated by terms such as "hyperacusis" and various other misnomers might more appropriately be called "phonophobia," as suggested by the writer.

A case of unilateral deafness with Bell's palsy and phonophobia on the side of the deaf ear was observed. Studies for analysis of this paradoxical phenomenon were performed and some new information obtained about the factors responsible for stapedioparalytic phonophobia.

The phenomenon became evident to be controlled by the joint presence of two factors: Unimpaired sensitivity of the ipsilateral middle ear structures and unimpaired cochlear function of at least one ear. Absence of either one of these two factors abolishes the phenomenon. This statement appears supported by the results of studies performed in another case of stapedioparalytic phonophobia with bilateral normal hearing.

Conditions in S. P. P. on one hand are compared with those significant for threshold of feeling and for the stapedius reflex on the other hand.

Factors possibly responsible for the effect of anesthesia on the stapedius reflex and on S. P. P. are discussed and plans of investigation are outlined.

The possibility of practical applications of the phonophobia test is discussed. It might be helpful as a diagnostic support in the symptomatology of otosclerosis.

It also might represent a warning signal in cases of latent dysfunction of the stapedius muscle. Administration of an artificial inner ear protection in such cases might compensate for the insufficiency of the natural "tutor labyrinthi."

Routine testing for phonophobia appears advisable in any case of Bell's palsy and whenever occupational or circumstantial exposure to potential acoustic traumatization calls for examination of the natural inner ear protectors.

BIBLIOGRAPHY.

1. MUELLER, J.: Elements of Physiology, p. 758, Philadelphia, 1843.

2. ERHARD: *Klin. Woch.*, Berlin, 51:531, Dec. 21, 1868.

3. LUCAE, A.: Die Accomodation und die Accomodation-stoerungen des Ohres. *Klin. Woch.*, Berlin, Nos. 14, 16, 17, 1874.

4. HITZIG, E.: Zur Peripheren Facialislaehmung. *Klin. Woch.*, Berlin, No. 2, 1869.

5. URBANTSCHISCH, V.: Lehrbuch der Ohrenheilkunde. 5th Ed. Urban und Schwarzenberg, Berlin Wien, p. 66, 1910.

6. KATO, T.: Quoted by Schaefer and Giesswein in Denker-Kahler, Handbuch der Hals-Nasen-Ohrenheilkunde, Berlin-Muenchen, VI:412-415, 1926.

7. LUESCHER, E.: Die Function des Musculus Stapedius beim Menschen. *Ztschr. f. Hals-Nasen-Ohrenh.*, 23:105, 1939.

8. KOBRAK, H.: Beobachtungen des Stapedius Reflexes am Menschen. *Ztschr. f. Hals-Nasen-Ohrenh.*, 32:8, 1832.

9. KOBRAK, H.: Ueber die Klinische Bedautung der Ohrmuskeln. *Ztschr. f. Hals-Nasen-Ohrenh.*, 31:32:370, 1932-1933.

10. KOBRAK, H.; LINDSAY, J.; PERLMAN, H., and DUBNER, H.: Effect of Limited Cochlear Lesions on Cochlear Potentials and Middle Ear Muscle Reflexes. *Arch. Otol.*, 27:59-66, Jan., 1938.

11. LINDSAY, J.; KOBRAK, H., and PERLMAN, H.: Relation of the Stapedius Reflex to Hearing Sensation in Man. *Arch. Otol.*, 23:671, 1936.

12. KOBRAK, H.; LINDSAY, J., and PERLMAN, H.: Value of the Reflex Contraction of the Muscles of the Middle Ear as an Indicator of Hearing. *Arch. Otol.*, 21:663, June, 1935.

13. ERB, W.: Ziemssen Cyclopedia of Practice of Medicine, 11:490, 1876.

14. BAZIRE: Case of Facial Paralysis with Impairment of Taste and Acoustic Hyperesthesia on the Same Side as the Paralysis. *Brit. Med. Jour.*, p. 249, Sept. 21, 1867.

15. BROWN-SEQUARD: Quoted by Bazire.

16. GRUENBERG, V.: In Denker-Kahler Handbuch der Hals-Nasen-Ohrenh., 6:900, 1926.

17. TSCHIASSNY, K.: The Site of the Facial Nerve Lesion in Cases of Ramsay Hunt's Syndrome. *Ann. Otol., Rhinol. and Laryngol.*, 55:152, Mar., 1946.

18. POLITZER'S Textbook of the Diseases of the Ear by Hilton J. Ballin. Philadelphia: Lea and Febiger, 1926.

19. PERLMAN, H.: Hyperacusis. *Ann. Otol., Rhinol. and Laryngol.*, 47: 947, 1938.

20. LIERLE, D., and REGER, S.: Threshold of Feeling in the Ear in Relation to Sound Pressures. *Arch. Otol.*, 23:653, 1936.

21. KRASSNIG, N.: Cocainwirkung auf das Mittel und Innenohr. *Ztschr. f. Hals-Nasen-Ohrenh.*, 31:384, 1932.

22. POTTER, A.: Function of the Stapedius Muscle. *Ann. Otol., Rhinol. and Laryngol.*, 45:638-643, 1936.

23. EGGSTON, A., and WOLFF, D.: Histopathology of the Ear, Nose and Throat. Williams and Wilkins Co., 1947.

FRANCISCUS SYLVIUS (FRANCOIS DE LE BOE), 1614-1672.

Founder of Iatro-Chemistry, a Great Teacher of Medicine, and Rightful Father of the Sylvian Eponyms.

WALTER A. WELLS, M.D.,
Washington, D. C.

Due to the fact that there were two great medical men of the past who bore the name of Sylvius, both distinguished in medical history under that name, there is much confusion as to which is intended to be honored by the word "Sylvian" applied to certain well-known anatomical structures.

These eponyms being anatomical are naturally of primary interest to the anatomist, but as they pertain to the brain they are of likewise interest to all medical men concerned with this region; especially the otologist, whose work comprises brain surgery.

The first Sylvius was Jacques Dubois. In English we would call him "Jack Wood," but he translated it into the Latin Jacobus Sylvius to indicate his dignified scholarship in keeping with the custom of the time.

His chief fame in medical history is that he was the teacher of the great Vesalius, with whom he entered into a very undignified controversy, calling him "Vesanus" meaning a fool, because he questioned the authority of Galen.

The second Sylvius, whom we might designate Sylvanus Secundus, was Francois de le Boë, a native of Hanau, Ger-

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FRANCISCUS SYLVIUS.

many. The family, however, was of French extraction, and the family name in the beginning no doubt was also DuBois, the same as that of the first Sylvius.

It was, therefore, natural that on becoming a scholar he also should assume the same Latin name and so he became Franciscus Sylvius.

The first Sylvius flourished in the sixteenth century; the second in the seventeenth. Time enough has elapsed to enable commentators to establish the authorship of either or both, but reference to modern medical dictionaries and histories

JACOB SYLVIUS.

will reveal that uncertainty and confusion as to the Sylvian eponyms still persist. The predominant opinion is they are so-named in honor of Jacobus, the first Sylvius.

That the credit has not been properly given to Franciscus, to whom as we shall show it certainly belongs, is no doubt due to the fact that being anatomical terms, they were on the one hand naturally attributed to the first Sylvius who was a well-known anatomist; while on the other hand, the second Sylvius

was so well known as the founder of a new system of medicine, called iatro-chemistry, that his early anatomical studies were completely overshadowed and forgotten.

The Sylvian eponyms are as follows:

Sylvian aqueduct; a passage which connects the third and fourth ventricles of the brain; aqueductus cerebri.

Sylvian fissure; a deep narrow sulcus or depression; which divides the anterior and middle lobes of the brain on each side; fissura cerebri lateralis.

Sylvian fossa; a depression on the cerebral hemispheres, situated between the arms of the Sylvian fissure; it marks the location of the important island of Reil; fossa cerebri lateralis.

Sylvian line; a line on the surface of the skull which indicates the position of the Sylvian fissure.

Sylvian point; the point of the Sylvian fissure marking the division into the anterior, ascendry and posterior limbs; also a corresponding point on the surface of the skull.

Sylvian tract; the region of the brain about the Sylvian fissure.

Sylvian vein; a vein which runs along the Sylvian fissure and crosses the hemisphere of the brain; vena cerebri media.

Sylvian ventricle; the fifth ventricle of the brain; cavum septi pellucida.

As well as we can learn the first description of what has widely become known as the Sylvian fissure appeared in a book entitled "Innstitutiones Anatomicae" by Kaspar Bartholin, published at Leyden in 1641.

Kaspar Bartholin was the first of a Danish family famous as anatomists. This work was not published during his lifetime but under the editorship of his son Thomas several years after his death.

Thomas at the time he was called on to bring out this work was a young man of 23, who had not yet taken up the profession of medicine.

Realizing that he was not sufficiently equipped for the task, he called to his assistance his friend Francois de le Boë, two years his senior and a recent graduate of medicine at the University of Basle.

Francois at this time was occupied almost solely with the science of anatomy and was giving lectures to students on the subject. His special interest was anatomy of the brain in which he was studying in a practical manner by painstaking dissections.

Included in the work is a bracketed contribution describing the anatomical configuration of the brain signed F. S.— which initials the editor identifies as referring to Franciscus Sylvius.

In 1668, there appeared in London an English translation of this Latin volume under the title "Bartholin's Anatomy from the precepts of his father and the observations of all modern anatomists together with our own," etc.

In this edition Thomas Bartholin writes "The windings of the brain I first learned from Franciscus Sylvius" and then goes on to give a description of them, in language which practically duplicated the bracketed contribution signed F. S., in the original work — as above mentioned.

In his own book, entitled "Disputationes Medicarum" published in 1663, Sylvius has given us the following description of the fissure:

"The whole surface of the cerebrum is everywhere quite deeply marked by gyri, similar to the convolutions of the small intestine and *especially by a notable fissure* or hiatus, beginning at the root of the eyes (optic tracts), passing backward along the temple above, not further than the roots of the medulla (crura cerebri) and dividing the cerebrum on either hand, with an upper much larger part and a lower

smaller one; which gyri ocurring the whole length and depth of the fissure — I may even say with the beginnings of lesser gyri at the very upper ends of the root."

How soon and to what extent the fissure came to be called Sylvian in honor of Franciscus we do not know, but certainly to some extent in the year 1774 when Haller in his "Bibliotheca Anatomica" wrote "Franciscus de le Boë described the *fissure which bears the name of its discoverer.*"

Other parts contiguous and related to the fissure came as a natural development thereafter to be called Sylvian, even though this author may not have originally described them.

We have a clear cut instance of this in the naming of the Sylvian artery by Vicq d' Azyr in his "Planche Anatomique," Paris, 1786, Vol. III.

On page 57 he writes referring to the artery, "Its volume is a little more than that of the anterior branch. I have given to it the name Sylvian artery because it runs into the fossa of that name. The Sylvian artery divides usually into three principal branches of which the middle is placed in the bottom of the fissure that *Sylvius de le Boë has described.*"

We believe that the above cannot be considered other than conclusive documentary evidence that to Franciscus Sylvius belongs the honor of having first described the Sylvian fissure and incidentally of fathering the other Sylvian eponyms closely related thereto.

Some question might be raised as to the so-called Sylvian aqueduct on the ground that this particular structure had been previously mentioned by the earlier Sylvius.

It is true that Jacobus noted the fact that a small canal exists in the brain connecting the third and fourth ventricles, but the observation was not original with him. It had been previously observed by others, among them Arantuius Berengarius, Oribasius and even by Galen; furthermore, the term aqueduct was never used by Jacobus. (See Dr. Frank Baker's excellent paper entitled "The Two Sylviuses," *Johns Hopkins Hospital Bulletin,* 1909, XX, 331.)

We trust that our stand in favor of Franciscus Sylvius in the matter of the eponyms will not be misinterpreted as a disparagement of the merits of Jacobus, especially as the latter has suffered already more than he has deserved from the hands of medical historians. This is due to the bad light in which that sturdy old sixteenth century anatomist stands as the uncompromising champion of Galenism.

Unfortunately for himself, but fortunately for medicine, he had a famous pupil who opposed him.

Vesalius had the courage to be one of the first to challenge the infallibility of Galen and the genius to prove his case. As a result he became the great hero in medical history, the Ajax who defied the lightning or the Prometheus who stole fire from the heaven and brought it down to earth for man's use; therefore, those who were opposed to him have been discredited and maligned.

In the acrimonious controversy which ensued between pupil and his former teacher, the latter sometimes went to a ridiculous extreme, as for example when it was plainly shown to him that Galen had wrongly described certain anatomical parts, he replied that Galen was right and man had changed since his time.

On the other hand, Vesalius was unfair, unjust, and when he asserted that Sylvius could not know human anatomy, because he never dissected the human body, he was apparently downright untruthful.

Commentators generally have repeated the statement of Vesalius, but evidence to the contrary appears in quotation which Dr. Baker has supplied us from the writings of Jacobus. "You would do well to dissect the bodies of those who have died of some disease in order that by recognizing the cause of the malady you may treat others wisely. Do not dissect only bodies of men but also those of monkeys and other animals similar to man. Yet I will recommend at first that you work only upon human bodies; thus you will obtain a profound knowledge of the different parts which you can apply in dissecting other animals.

"Now many do not like at first to view the dissection of men, and cannot endure it without great disturbance of mind. Notwithstanding this, they ought if they can to accustom themselves from the very beginning to look diligently at the body of man as it is being dissected and then to perform the dissection with their own hands."

If Jacobus Sylvius was such a poor teacher as Vesalius would have us believe, it is strange that he should have remained for two years as one of his pupils. Another famous pupil who apparently appreciated him was the great Servetus, the man who by his discovery of the lesser circulation anticipated Dr. Harvey.

Jacobus came of such a poor family they were not able to afford much for his education.

He began teaching in Paris before he had received his medical degree, but he had in a short time such a great following of students that the regents of the University of Paris took steps to prevent his holding class.

When this happened, out of his savings he went to the University of Montpelier and received a degree there at the age of 53. He then returned to Paris and became professor of Anatomy at the University of Treguier.

Here pupils flocked to him from all over Europe and his classes are said to have reached as high sometimes as 500.

So much for Sylvius Primus. Let us now return to the particular subject of this sketch, Sylvius Secundus — or as he is generally called, Franciscus Sylvius.

Francois de le Boë came of a French Huguenot family which fled France to escape persecution.

His grandfather, the emigre, had a son Isaac who married Anne de la Vignette of a good French family of Cambria. Of this marriage came Francois who when he was old enough was sent to school in Sedan, a French provincial town where the Huguenots were tolerated.

The family were in good circumstances and his education was accordingly broad and thorough.

After a course of study in which chief attention was centered on physics, botany, and zoology he set on a tour of travel considered in those days as indispensable to the complete education of a young gentleman.

He spent sometime in Paris and other seats of learning, including Basle, Switzerland.

Here he enrolled at the University for a course in medicine and graduated in 1637, at the age of 23.

He continued in residence in Basle for the following year or so and might have remained longer, but his father desired him to return and set up for practice at his home town of Hanau.

In a short time, however, he again felt the urge to seek an atmosphere of learning, and he decided to go to Leyden. This Dutch city had been growing considerably in importance as a medical center, especially for the teaching of anatomy.

This was for two reasons: one, that most of the Italian schools had imposed restrictions which excluded non-Catholics; the other, that Holland was more liberal than neighboring countries in the matter of human body dissection.

At Leyden, Sylvius entered enthusiastically in the study of anatomy and, as we have noted, made in the very beginning of his career observations that stamp him as one of the seventeenth century pioneers in that science.

Young de le Boë liked research work and he no doubt was flattered to be called by a member of the Bartholin family to assist in publishing the works of the great Kaspar; however, his family and friends urged him to engage in private practice, and the best place for that according to all accounts was the thriving metropolis of Amsterdam, which was at the same time a great center for men interested in science and philosophy, as well as medicine.

His success as a practioner was immediate and very great; in fact, he is said to have taken the city as it were by storm. Not only was it at once apparent that he was a young man of wide information and extraordinary intelligence, but also that he had an engaging personality. He was of strikingly handsome face and figure, with a frank, sincere expression and pleasing manners.

He became the most sought after practitioner of the city, and his consultation rooms became the gathering place of the wealthy, the fashionable and the learned; but his popularity was not with these alone: he was equally popular with the poor and the less favored, for his sympathy for the sick extended to all classes, and to those too poor to pay he gave his services free. Then, as today, it is usually the man who has the most to do who will some way find time to do more, and Sylvius, notwithstanding the insistent demands of a flourishing private practice, managed to find extra time to devote to the fundamental problems of medicine.

Ever since his student days at Basle he had been much interested in some aspects of the doctrine propounded by the Belgian philospher-physician, Jean Baptiste von Helmont.

This doctrine was a strange mixture of sound scientific principles and weird, meaningless mysticism.

Von Helmont was an asute observer and a careful experimenter, but he was also a firm believer in alchemy, astrology and other vagaries.

He believed all the processes of the living bodies were the direct result of fermentation due to chemical action, and that these changes could be brought about only through the influence of a certain subtle spirit which he called "archeus" or "blas."

There was a special archeus for each separate organ; and a general overseeing (archeus influx) for the whole body.

The seat of the soul (anima sensitiva), he located in the pit of the stomach.

Sylvius adopted the idea of fermentation as the important phenomenon of body change, but he rejected the idea of the archeus as implementing agent.

He believed that the chemical processes of the living body were no different from those in inanimate matter and he proceeded to concoct a scheme for treating disease based on the chemistry of the laboratory.

Sylvius must have seen much of another resident of Amsterdam who was likewise engaged in the study of the fundamentals of the living body, and who is regarded as one of the founder of a new system of medical treatment.

Descartes had come from France to live in Amsterdam as a voluntary exile and continued to reside there the remainder of his life. Although not a physician, he considered the study of the working of the living body as an important branch of his philosophy. He practiced dissection, wrote a work on physiology and was much quoted by the adherents to that school of medical practice known as Iatro-physics. It would have been better, however, if he had confined himself to pure philosophy and left medicine to those better versed in that subject.

He opposed Harvey's theory of the circulation and held that the heart was merely the source of the body heat. Among other errors which he propagated was the idea that the nerves were hollow and conveyed a juice (succus nerveus) which was responsible for motion and sensation. Differing from Von Helmont, he placed the seat of the soul in the little pea-sized organ of the brain known as pineal gland.

On the other hand, his philosophy is profound, and his work on the subject of optics was of the highest value and laid the true foundation of that science.

In 1658, Sylvius was called to assume the chair of medicine at the University of Leyden.

He hesitated a long while before leaving, and when he finally decided to accept, his departure from Amsterdam was a cause of gloom and regret throughout the city.

Sylvius, like his predecessor of the same name, became a popular teacher of medicine. Like him, he attracted to his classes pupils from all over Europe, and like him had among them some famous pupils; but unlike him, he did not quarrel with any of his pupils. On the contrary, the utmost of good feeling existed continually between him and them. He was ever ready to praise their work and give it prominence, and they were enthusiastic in their appreciation of his teaching and leadership.

Sylvius enjoyed great success as a teacher for two reasons: one, that he was ever full of new and interesting ideas, and the other because he presented his subject in eloquent language and with an impressive manner.

Among his prominent pupils we must mention especially Jan Swammerdam, the discoverer of the red blood corpuscles, Regmer de Graaf, the discoverer of the ovarian (Graafian) follicles, Frederik Ruysch, most expert dissector of his era, and discoverer of several anatomical structures which bear his name, and Niels Stensen, "the learned Dane," who discovered the parotid duct.

The Englishman, Thomas Willis, from whom we have the circle of Willis, is sometimes referred to as one of the famous pupils of Sylvius. He was, however, so far as we can learn, never enrolled as a student at the Leyden University. He must be considered rather as a disciple of the great teacher, as he became the champion of the iatro-chemical school in England.

Sylvius was not content with existing knowledge in chemistry, so he established a laboratory in which to experiment with the mineral salts, and especially to study the reaction from admixture with various acids.

He held that good health consisted in a proper balance between acids and alkalis and that an excess of one in the body over the other produced "acrimonies" responsible for ill-health.

While this was an over-simplification of the complexities of body chemistry, it, nevertheless, was useful in turning medical thought away from the old humoral doctrine and into a path which was to lead eventually to a fruitful field of research.

He devoted much attention to the physiology of digestion, and recognized in the secretion of saliva an important factor in the first stage of this process; it was seen as giving rise to a fermentation, producing the first change in the food, to be followed by other fermentations brought about by the bile and the pancreatic juices.

He followed up Stensen's discovery of the parotid duct in sheep by demonstrating its presence in man.

He recognized the fact that while some glands had ducts, there were others which were ductless, and he employed the terms conglobate and conglomerate to distinguish between two types of glands, which later came to be designated as simple and compound.

There is also to his credit two original observations in the domain of neurology.

He was the first to differentiate between thermal and tactile sensation, and he was the first to make a distinction between continuous muscular tremor and that which was initiated by voluntary movement (the so-called intentional tremor).

In the line of pathology he made an outstanding contribution — one which alone should entitle him to a high place in the annals of medical achievement: it was he who first described the tubercles of the lung. He observed their progress into the formation of cavities and he grasped their relationship with the disease then called phthisis.

He wrote: "I more than once found large and small tubercles which on section were found to contain pus. I believe that these tubercles became purulent and are changed into cavities which are lined with their membranes. In these tubercles I hold that not infrequently phthisis has its origin."

In Sylvius' day very little scientific attention was given to diseases of children. These were for the most part discussed only in pamphlets gotten out by charlatans for the exploitation of the laity. In "De moribus infantum" published in Amsterdam, 1674, Franciscus Sylvius made one of the first attempts to present what might be called scientific consideration of the subject.

A few years later there appeared in London an English translation of the treatise, which unfortunately was not altogether free of some commercial coloring.

Sylvius recognized better than most men of his time the delicate nature of a young child's constitution, and he advised against drastic drugging then much employed and recommended instead the use of very mild remedies. He especially favored the volatile spirits. He suggested the use of aromatics for whooping cough. Incidentally, he was opposed to excessive bleeding in all cases, adults as well as children.

Sylvius was early among the great authorities to recognize the significance of the theory of the circulation of the blood as propounded by Harvey.

He made experiments on his own account which tended to confirm it, and it was largely through his influence that it was accepted in Holland sooner than in other European countries.

Perhaps that for which more than anything else he deserves the plaudits of posterity was his pioneering in clinical instruction.

During the Hippocratic era it had been a custom for some physicians who were teachers to take a group of students on their rounds to see patients.

Some of these patients have revealed this fact in telling us how even worse than the illness was the thumping and mauling they received at the hands of the young medical greenhorns who followed at their doctor's heels.

Bedside teaching, however, went out of fashion and for many centuries only didactic methods prevailed.

There had come of late a slight revival of the clinical approach in some of the Italian universities.

It received no encouragement, however, in the severe scholastic regime of either France or England.

Sylvius was the first to introduce it anywhere north of the Alps.

It was a modest beginning — a small infirmary of a dozen or so beds — but was a very important one. Leyden was beginning to enjoy under Sylvius a kind of fame which reached its zenith under his successor, Boerhaave, who, continuing and enlarging this practice, made it the leading center for clinical instruction of all Europe.

Writing in 1664, Sylvius said: "I have led my pupils by the hand to medical practice, employing a method unknown at Leyden or perhaps anywhere else; that is, taking them daily to visit the sick in public hospital. There I have put the symptoms of disease before their eyes, have let them then hear the complaints of the patient and have asked their opinion as to the cause and rational treatment of each case and the reasons for their opinion. Then I have given them my own judgment on every point. Together with me they have seen the happy results of treatment when God has granted to our cases a restoration of health: or they have assisted in examining the body when the patient has paid the inevitable tribute to death."

An admiring contemporary, Schact, has thus described his methods:

"When he came with his pupils to the patient and began to teach he appeared completely in the dark as to the cause or nature of the affection the patient was suffering from and at first expressed no opinion of the case.

"He then began by questions put to different members of his audience to fish out everything and finally united the facts, discovering in this manner a complete picture of the disease

in such way that the students received the impression that they themselves had made the diagnosis and not learned it from him."

To what position in the history of medicine shall Franciscus Sylvius be assigned?

Sir Michael Foster in his classical work, "Lectures on the History of Physiology," has expressed the opinion that he was to be considered as a very able expositor of the facts, but not a great reasoner.

Exception may well be taken, however, to this opinion of Foster on the ground that he was not altogether a competent judge.

What better proof of this than his statement that it was not Franciscus but his predecessor Jacobus who deserves the honor of being regarded as the discoverer of the Sylvian fissure?

Franciscus did, as we have pointed out, make worthwhile original observations in anatomy, chemistry, physiology, pathology and therapeutics.

His views, of course, in the light of modern knowledge were not in all points perfect, but they were generally ahead of his day, and in some respects remarkably progressive and modern.

It is especially noteworthy that when defective they were leading in the right direction.

In chemistry his ideas of alkalis and acid led to the introduction of many valuable mineral salts; in physiology his idea of the rôle of fermentation in the process of digestion led to the discovery of important enzymes.

Especially do we stress the fact that the early studies in anatomy made by Franciscus Sylvius have generally been overlooked.

Certainly, true justice cannot be done his reputation unless he be given the credit he so clearly deserves of being recognized as the legitimate father of the famous Sylvian anatomical eponyms.

JOINT MEETING SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY AND NORTH CAROLINA EYE, EAR, NOSE AND THROAT SOCIETY.

The joint meeting of the South Carolina Society of Ophthalmology and Otolaryngology and the North Carolina Eye, Ear, Nose and Throat Society will be held at Hotel Poinsett, Greenville, S. C., Sept. 12 through Sept. 15. The following program will be presented:

Dr. A. D. Ruedemann, professor of ophthalmology, Wayne University, Detroit, Mich.:

1. The Differential Diagnosis Between Unilateral and Bilateral Ocular Protrusion.
2. The End-Results with New Radium-D Applicator in Comparison to Radon.
3. Ocular Manifestations of Allergy.

Dr. Peter C. Kronfeld, department of ophthalmology, Illinois Eye and Ear Infirmary, University of Illinois, Chicago, Ill.:

1. Differential Diagnosis of Acute Glaucoma.
2. Prognosis of Retinal Detachment.
3. Newer Drugs in Ophthalmology.

Dr. Rudolph Aebli, professor of ophthalmology, New York University, Bellevue Medical Center, Post-Graduate Medical School, New York, N. Y.:

1. The Relationship of Muscle Imbalances to the Palpebral Aperture and Pseudo-Ptosis.
2. Principles of Ocular Muscle Surgery.
3. Congenital Muscle Anomalies.

Dr. Carl C. Johnson, associate, department of ophthalmology, Harvard University, Boston, Mass.:

1. Surgical Treatment of Ptosis.

2-3. The Diagnosis and Surgical Treatment of Glaucoma.

Dr. Preston C. Iverson, New York, N. Y.:

1. Neoplasms of the Lip, Nose and Eyelid and Plastic Repair of the Lesions.

2. Congenital Deformities of the Face.

Dr. Louis H. Clerf, Philadelphia, Pa.:

1. Cough Viewed from Otolaryngologic Standpoint.

2. Paralysis of Larynx: Surgical Treatment.

3. Malignant Neoplasms of Larynx.

Dr. Kenneth M. Day, Pittsburgh, Pa.:

1. Clinical Management of Deafness.

2. Ménière's Disease.

Dr. Russell A. Sage, Indianapolis, Ind.:

1. Diseases of the Mouth and Tongue.

South Carolina Society of Ophthalmology and Otolaryngology: President, Dr. Pierre G. Jenkins; Vice-President, Dr. Murdock Walker; Secretary-Treasurer, Dr. Roderick Macdonald.

North Carolina Eye, Ear, Nose and Throat Society: President, Dr. James Harrill; Vice-President, Dr. G. M. Billings; Secretary-Treasurer, Dr. MacLean B. Leath.

For further information, address Dr. Roderick Macdonald, Secretary, South Carolina Society of Ophthalmology and Otolaryngology, Rock Hill, S. C., or Dr. MacLean B. Leath, Secretary, North Carolina Eye, Ear, Nose and Throat Society.

SECOND PAN AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY — MONTEVIDEO-BUENOS AIRES, JAN. 8-15, 1950.

EXECUTIVE COMMITTEE.

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An interesting and instructive program has been arranged.

Subscription—$10, or its equivalent in Uruguayan money.

The following week (Jan. 16-21) there will take place in Montevideo and Buenos Aires, operative demonstrations for those who wish to attend.

Travel arrangements should be made immediately through Thomas Cook & Sons or Pan American Airways.

All those interested in attending this Congress should communicate at once with the delegate in the U. S. A. and Canada, Dr. Chevalier L. Jackson, 3401 North Broad Street, Philadelphia 40, Pa.

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION.

As of February 1, 1949.

Acousticon Model A-100.
Manufacturer: Dictograph Products Corp., 580 Fifth Ave., New York 19, N. Y.

Aurex (Semi-Portable); Aurex Model C-B, Model C-A, Model F and Model H.
Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago, Ill.

Beltone Mono-Pac; Beltone Harmony Mono-Pac; Beltone Symphonette.
Manufacturer: Beltone Hearing Aid Co., 1450 W. 19th St., Chicago, Ill.

Dysonic Model 1.
Manufacturer: Dynamic Hearing Aids, 43 Exchange Pl., New York 5, N. Y.

Electroear Model C.
Manufacturer: American Earphone Co., Inc., 10 East 43rd St., New York 17, N. Y.

Gem Hearing Aid Model V-35.
Manufacturer: Gem Ear Phone Co., Inc., 50 W. 29th St., New York 1, N. Y.

Maico Type K; Maico Atomeer.
Manufacturer: Maico Co., Inc., North Third St., Minneapolis, Minn.

Mears Aurophone Model 200; 1947—Mears Aurophone Model 98.
Manufacturer: Mears Radio Hearing Device Corp., 1 W. 34th St., New York, N. Y.

Micronic Model 101 (Magnetic Receiver).
Manufacturer: Micronic Co., 727 Atlantic Ave., Boston 11, Mass.

Microtone T-3 Audiomatic; Microtone T-4 Audiomatic; Microtone T-5 Audiomatic.

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National Cub Model; National Standard Model; National Star Model.

Manufacturer: National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.

Otarion Model A-1; Otarion Model A-3; Otarion Models A-4 J and S; Otarion Model E-1; Otarion Model E-1S; Otarion Model E-2; Otarion Model E-4.

Manufacturer: Otarion Hearing Aids, 159 N. Dearborn St., Chicago, Ill.

Paravox Models VH and VL; Paravox Model XT; Paravox Model XTS; Paravox Model Y (YM, YC and YC-7).

Manufacturer: Paraphone Hearing Aid, Inc., 2056 E. 4th St., Cleveland, Ohio.

Precision Table Hearing Aid.

Manufacturer: Precision Electronics Co., 850 W. Oakdale, Chicago 14, Ill.

Radioear 45-CM; Radioear Model 45-M-magnetic air conduction receiver; Radioear Model 45-M-magnetic bone conduction receiver; Radioear Permo-Magnetic Uniphone; Radioear Permo-Magnetic Multipower—report not yet published.

Manufacturer: E. A. Myers & Sons, 306 Beverly Rd., Mt. Lebanon, Pittsburgh, Pa.

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Sonotone Audicles No. 530, No. 531 and No. 533; Sonotone Model 600; Sonotone Model 700; Sonotone Model 900.

Manufacturer: Sonotone Corp., Elmsford, N. Y.

Superfonic Hearing Aid.

Manufacturer: American Sound Products, Inc., 2454 S. Michigan Ave., Chicago, Ill.

Televox Model E.

Manufacturer: Televox Mfg. Co., 117 S. Broad St., Philadelphia 7, Pa.

Telex Model 22; Telex Model 97; Telex Model 612; Telex Model 900; Telex Model 1020; Telex Model 1550.

Manufacturer: Telex, Inc., Minneapolis 1, Minn.

Tonemaster Model Royal.

Manufacturer: Tonemasters, Inc., 1627 Pacific Ave., Dallas 1, Tex.

Trimm Vacuum Tube No. 300.

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Council Meeting, Hotel Statler, New York City, Jan. 6, 1950.
Combined Meeting, Southern and Middle Sections, Peabody Hotel, Memphis, Tenn., Jan. 16-17, 1950.
Western Section, Medical Society Building, Los Angeles, Calif., Jan. 21-22, 1950.

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Second Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology: Montevideo, January, 1950

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Secretary of Section on Otolaryngology: Dr. Leland R. House.

Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd., Los Angeles, Calif.

Time: 6 P.M., fourth Monday of each month from September to May, inclusive.

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